County Deer Advisory Council
Deer Metrics

Fall 2014

Walworth County

CDAC Metrics Document
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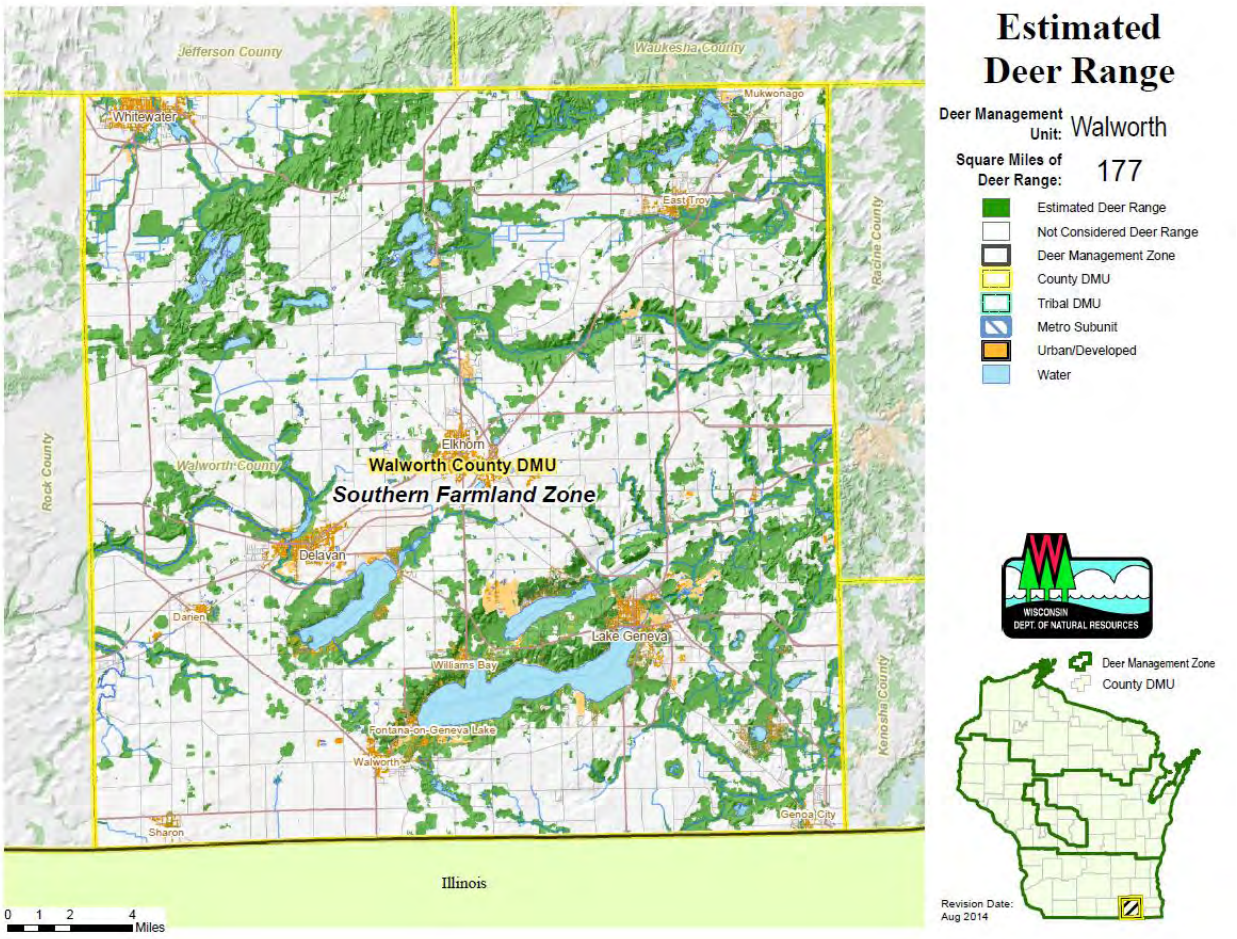
Walworth County Deer Management Unit



The Walworth County Deer Management Unit is located in the Southern Farmland Zone. Approximately 30 percent of the unit is considered suitable deer range. The unit is dominated by farmland with a patchwork of isolated woodlands, wetlands, lakes and urban centers. About 12,000 acres of state-owned land provide public hunting opportunities. These areas include Kettle Moraine State Forest, Turtle Creek Wildlife Area, Turtle Valley Wildlife Area, Bloomfield Wildlife Area, Troy Wildlife Area and other scattered wildlife areas and state properties. Buck harvest densities on average are 3 bucks per square mile of deer range. Management concerns include agricultural damage, deer-vehicle collisions, reduced forest regeneration and Chronic Wasting Disease. Currently, 71 deer have tested positive for CWD with most cases occurring in the western half of the unit. For the latest information on CWD in this unit, please visit the following DNR webpage: http://dnr.wi.gov/topic/wildlifehabitat/prevalence.html.

The Deer Hunter Experience

Survey and Statistics Metrics

Metric Type: Harvest/Hunter effort Surveys

Background: These are typically surveys that are used to measure annual variation in animal abundance, harvest, hunter participation, hunter effort, hunter techniques, and hunter opinions on current and potential season frameworks.

Results from these surveys are typically used to measure the year-to-year fluctuation in harvest, animal abundance, and hunter activity. These data are most useful when looked at over a multi-year period of time, and comparing yearly data with the long term average or trend. It is possible that unique yearly conditions could influence the results from a survey, but that the overall trend is unaffected by these conditions.

Collection and analysis methods:

Mandatory in-person deer harvest registration has been in place in Wisconsin since the 1953 deer season. Season of kill, location of kill, deer type and weapon used are what has normally been collected. In-person registration has allowed Wisconsin DNR biologists direct contact with the hunter and the animal they harvested allowing for easy collection of age, antler development, and disease sampling. These data have been the most important measures of the deer herd the State has collected.

Through the 2013 deer seasons, all deer harvested (archery and gun) must be brought to a WDNR designated deer registrations station within a set amount of time for the hunter to legally possess the kill. Changes to this system will begin with electronic registration available to some hunters in 2014)

Hunter harvest/effort surveys are typically mail surveys conducted at the end of the hunting seasons. A random selection of survey participants is sent a survey asking questions about the past hunting season. Typically questions pertaining to hunter participation, effort, techniques, interference, and satisfaction are asked.

More recently we have added web-based surveys to provide all hunters a vehicle to report what they are seeing while out deer hunting. These surveys are usually not opinion surveys, but a chance for the WDNR to enhance the hunting experience while obtaining some data on what and how frequently hunters are seeing wildlife. These surveys are usually web based and are modeled after other states in the Midwest that use hunter observations as an index to abundance for wildlife species.

Using the metric:
Results can and do fluctuate from year to year as deer densities, permit levels, hunter effort, weather, rule changes, season length, hunter selection, and hunter efforts change. Comparing yearly variations may have some value, while comparing year to year variations to the long-term mean or long-term trend will more likely produce more meaningful and reliable results.

Survey (year span)	Survey group	Use / limitations
Deer registration (1953-present)	All deer harvested	• Annual measure of hunter harvest at a management unit level by deer type. • Most reliable of all survey data with the longest span of coverage. • Season lengths and weather can and do effect harvest • No measure of compliance is made and only assumed (100%).
Archery and Gun deer Hunter survey (1994-present)	Random selection of archery and gun hunters	• Annual/periodic measure of hunter participation, efforts, and attitudes. • Sample sizes can vary do to special concerns or a need to collect data at a finer scale. May not always be comparable at the same scale • Hunter prestige bias is present but unknown • No correction for hunters that do not fill out or return a survey
Hunter Observation Survey (2009-present)	Voluntary observations survey for deer hunters	• Measure of animals seen by unit of effort • No objective sampling technique • Solicitation techniques varied • Small sample size in lightly hunted areas

Limitations and precautions: Registration of harvested deer has been the backbone of all deer surveys done by the WDNR. Accurate and reliable harvest data has provided the WDNR with a means to measure many different aspects of deer and hunters in the state. Missing or incomplete records are sometimes a problem for early years data. The effects of weather, deer abundance, season length, permit issuance, and hunter attitudes all play a role in harvest, but the extent of the effect is unknown and not measured.

Hunter surveys are subject to hunter biases which are difficult to measure and mostly unaccounted for. Lightly hunted or unhunted areas are not likely being represented by the small size of the sample taken for these areas. Voluntary surveys are uncontrolled for sampling and are not representative of the hunting public. They are subject to sampling size issues, hunter prejudices, poor coverage, and ability to access the survey via a computer.

Future needs: Measures of registration compliance will be import as we move from in-person registration to e-registration in 2015. Increasing response rates and increasing volunteerism will also produce more reliable results at a finer scale.

Finding innovative ways to record hunter effort and sightings using mobile devices will aid in the collection of result in a timely fashion.

Additional background materials related to this metric (if necessary)
Most harvest and hunter survey reports are available for viewing on the Wisconsin DNR website dnr.wi.gov keyword "***wildlife reports***"

**** Deer Harvest History by Deer Zone/County/Land Ownership **** 08/08/14

*** Deer Zone:Southern Farmland County:WALWORTH Ownership: Public ***

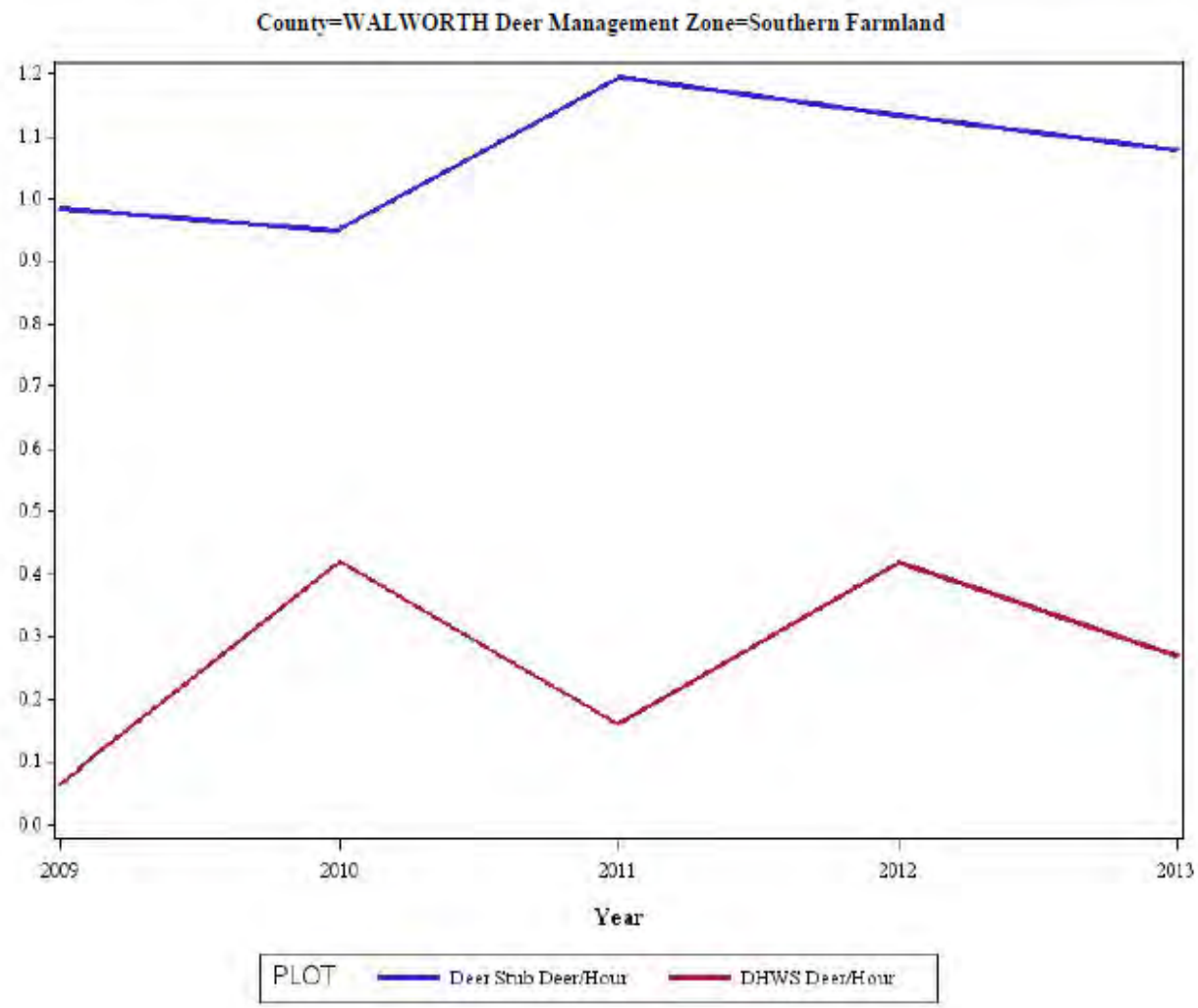
YEAR:	2006	2007	2008	2009	2010	2011	2012	2013
TOTAL AREA SQ MI	27	27	27	27	27	27	27	27
DEER RANGE SQ MI	22	22	22	22	22	22	22	22
GUN ANTLERED	3	40	21	17	24	51	40	43
GUN ANTLERLESS	39	122	140	162	154	97	115	94
GUN TOTAL	42	166	170	193	185	158	159	142
BOW ANTLERED	0	12	10	19	11	29	21	34
BOW ANTLERLESS	10	47	44	53	70	36	54	38
BOW TOTAL	10	59	55	78	86	67	77	76
TOTAL ANTLERED	3	52	31	36	35	80	61	77
TOTAL ANTLERLESS	49	173	194	235	236	145	175	141
TOTAL KILL	52	225	225	271	271	225	236	218
ANTLERLESS:ANTLERED	16X	3.3X	6.3X	6.5X	6.7X	1.8X	2.9X	1.8X
% BOW	19	26	24	29	32	30	33	35
KILL/SQ_MI OF DR RANGE	2	10	10	13	13	10	11	10
DATE OF BOW START	16SEP	15SEP	13SEP	12SEP	18SEP	17SEP	15SEP	14SEP
DATE of 9-DAY START	18NOV	17NOV	22NOV	21NOV	20NOV	19NOV	17NOV	23NOV

**** Deer Harvest History by Deer Zone/County/Land Ownership **** 08/08/14

*** Deer Zone:Southern Farmland County:WALWORTH Ownership: Private ***

YEAR:	2006	2007	2008	2009	2010	2011	2012	2013
TOTAL AREA SQ MI	549	549	549	549	549	549	549	549
DEER RANGE SQ MI	156	156	156	156	156	156	156	156
GUN ANTLERED	520	309	314	249	266	313	377	262
GUN ANTLERLESS	672	907	932	804	809	470	529	467
GUN TOTAL	1208	1227	1292	1099	1109	812	924	751
BOW ANTLERED	226	123	181	120	139	157	202	220
BOW ANTLERLESS	181	326	477	328	413	187	239	227
BOW TOTAL	413	455	670	472	570	353	446	453
TOTAL ANTLERED	746	432	495	369	405	470	579	482
TOTAL ANTLERLESS	875	1250	1467	1202	1274	695	791	722
TOTAL KILL	1621	1682	1962	1571	1679	1165	1370	1204
ANTLERLESS:ANTLERED	1.2X	2.9X	3.0X	3.3X	3.1X	1.5X	1.4X	1.5X
% BOW	25	27	34	30	34	30	33	38
KILL/SQ_MI OF DR RANGE	10	11	13	10	11	7	9	8
DATE OF BOW START	16SEP	15SEP	13SEP	12SEP	18SEP	17SEP	15SEP	14SEP
DATE of 9-DAY START	18NOV	17NOV	22NOV	21NOV	20NOV	19NOV	17NOV	23NOV

Deer Seen per Hour Hunted By County and Deer Management Zone
2009-2013

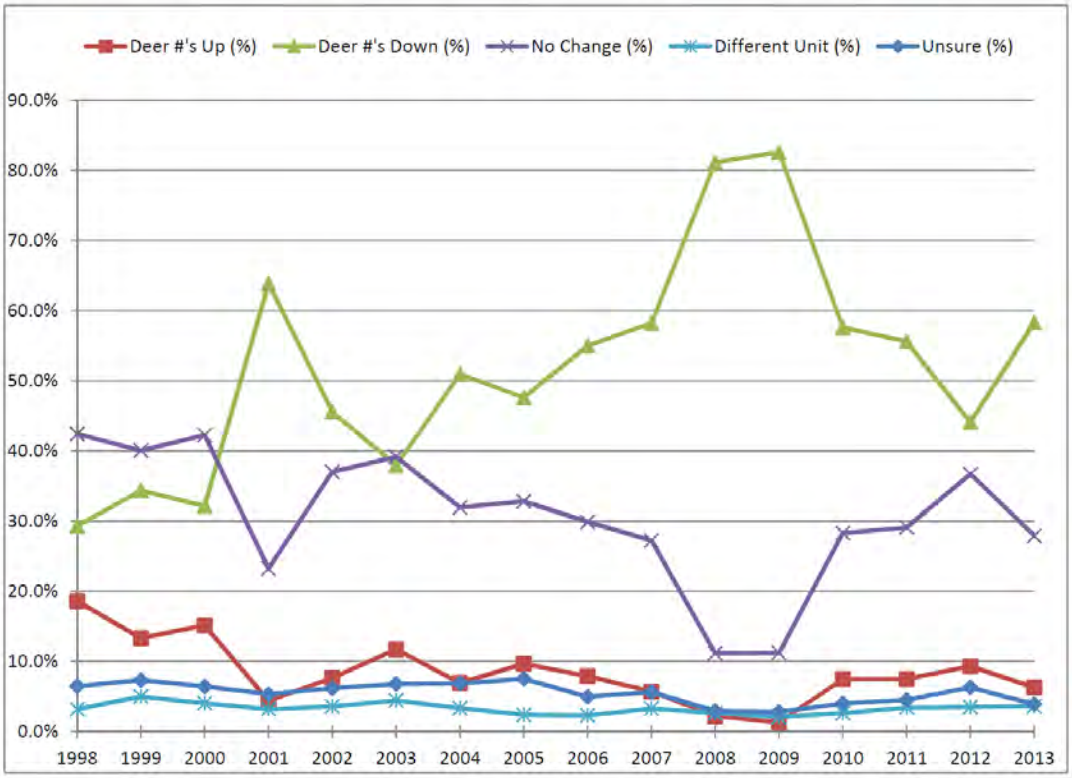


Deer Stub = Deer Registration Data
DHWS = Deer Hunter Wildlife Survey Data

Statewide Gun Deer Hunter's Impressions of Deer Numbers

In your hunting area, how have deers numbers changed from the last year?

Region	Year	Deer #'s Up (%)	Deer #'s Down (%)	No Change (%)	Different Unit (%)	Unsure (%)
Statewide	1998	18.6%	29.3%	42.4%	3.2%	6.5%
Statewide	1999	13.3%	34.3%	40.0%	5.0%	7.3%
Statewide	2000	15.1%	32.2%	42.3%	4.0%	6.4%
Statewide	2001	4.4%	63.9%	23.2%	3.2%	5.4%
Statewide	2002	7.6%	45.6%	37.0%	3.6%	6.2%
Statewide	2003	11.7%	37.9%	39.1%	4.4%	6.8%
Statewide	2004	6.9%	50.9%	31.9%	3.3%	6.9%
Statewide	2005	9.7%	47.6%	32.8%	2.4%	7.5%
Statewide	2006	7.9%	55.0%	29.9%	2.3%	5.0%
Statewide	2007	5.7%	58.2%	27.2%	3.3%	5.6%
Statewide	2008	2.2%	81.1%	11.1%	2.6%	2.9%
Statewide	2009	1.3%	82.6%	11.2%	2.1%	2.8%
Statewide	2010	7.5%	57.6%	28.3%	2.6%	4.0%
Statewide	2011	7.5%	55.6%	29.1%	3.4%	4.5%
Statewide	2012	9.3%	44.1%	36.7%	3.5%	6.3%
Statewide	2013	6.3%	58.3%	27.9%	3.6%	3.9%

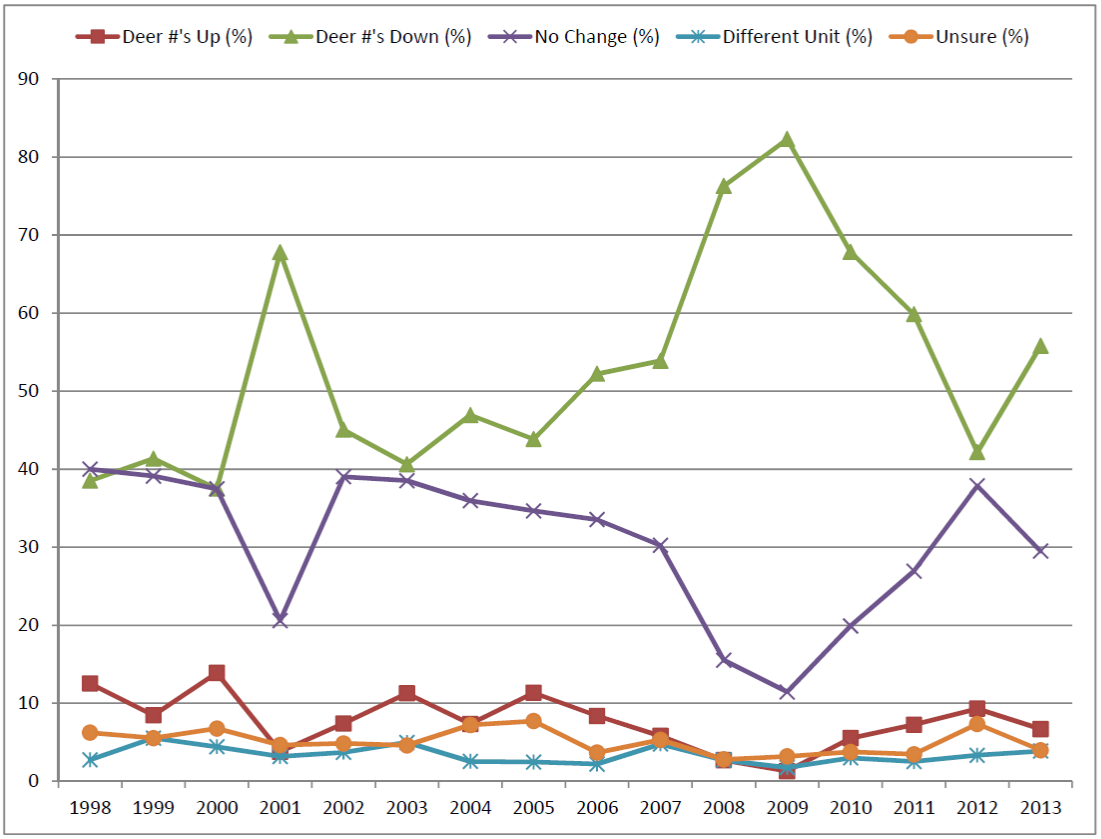


Data derived from a mailed survey of gun deer hunters

Southern Farmland Gun Deer Hunter's Impressions of Deer Numbers

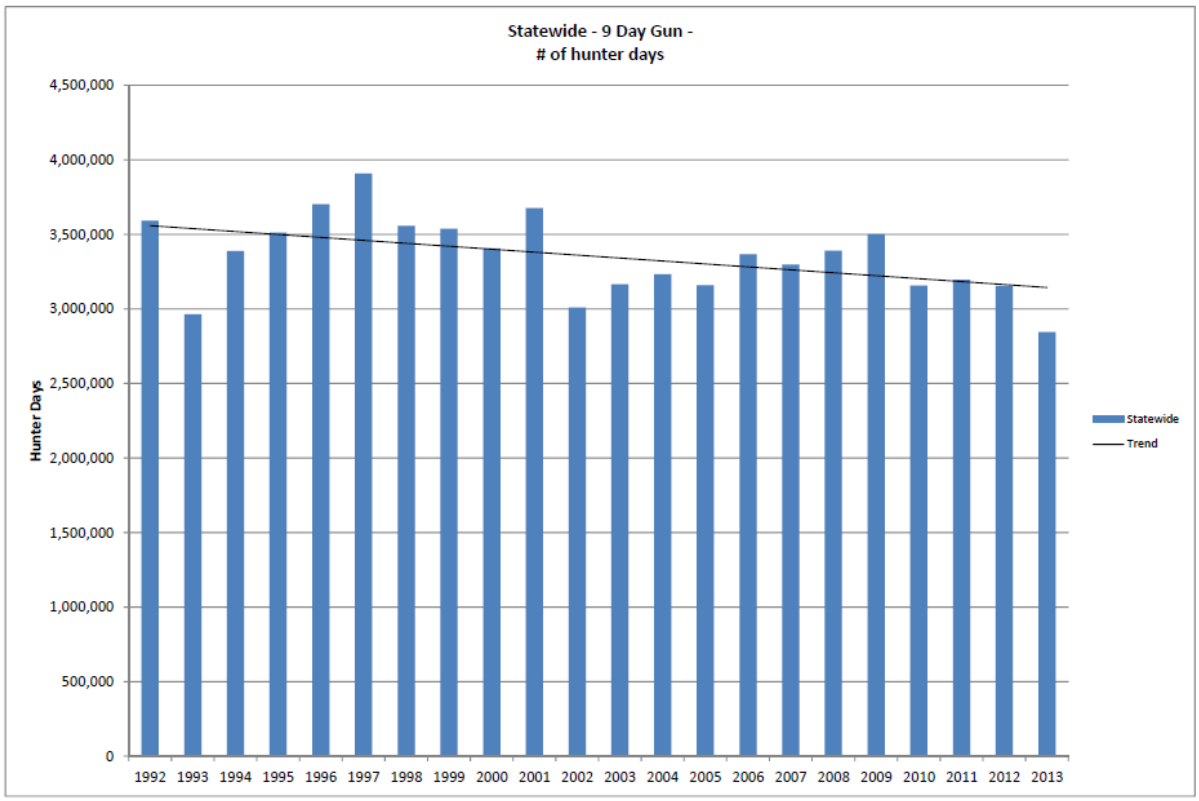
In your hunting area, how have deers numbers changed from the last year?

Region	Year	Deer #'s Up (%)	Deer #'s Down (%)	No Change (%)	Different Unit (%)	Unsure (%)
Southern Farmland	1998	12.53	38.51	40	2.74	6.22
Southern Farmland	1999	8.46	41.34	39.11	5.54	5.54
Southern Farmland	2000	13.88	37.47	37.47	4.42	6.76
Southern Farmland	2001	3.79	67.8	20.59	3.17	4.65
Southern Farmland	2002	7.4	45.03	39.03	3.7	4.85
Southern Farmland	2003	11.27	40.63	38.53	4.98	4.59
Southern Farmland	2004	7.35	46.93	35.96	2.54	7.22
Southern Farmland	2005	11.33	43.84	34.65	2.46	7.72
Southern Farmland	2006	8.38	52.21	33.53	2.21	3.68
Southern Farmland	2007	5.81	53.88	30.23	4.78	5.3
Southern Farmland	2008	2.7	76.29	15.51	2.7	2.81
Southern Farmland	2009	1.3	82.29	11.45	1.77	3.19
Southern Farmland	2010	5.51	67.83	19.9	3	3.75
Southern Farmland	2011	7.24	59.84	26.93	2.52	3.46
Southern Farmland	2012	9.29	42.16	37.86	3.33	7.35
Southern Farmland	2013	6.7	55.8	29.5	3.87	3.99



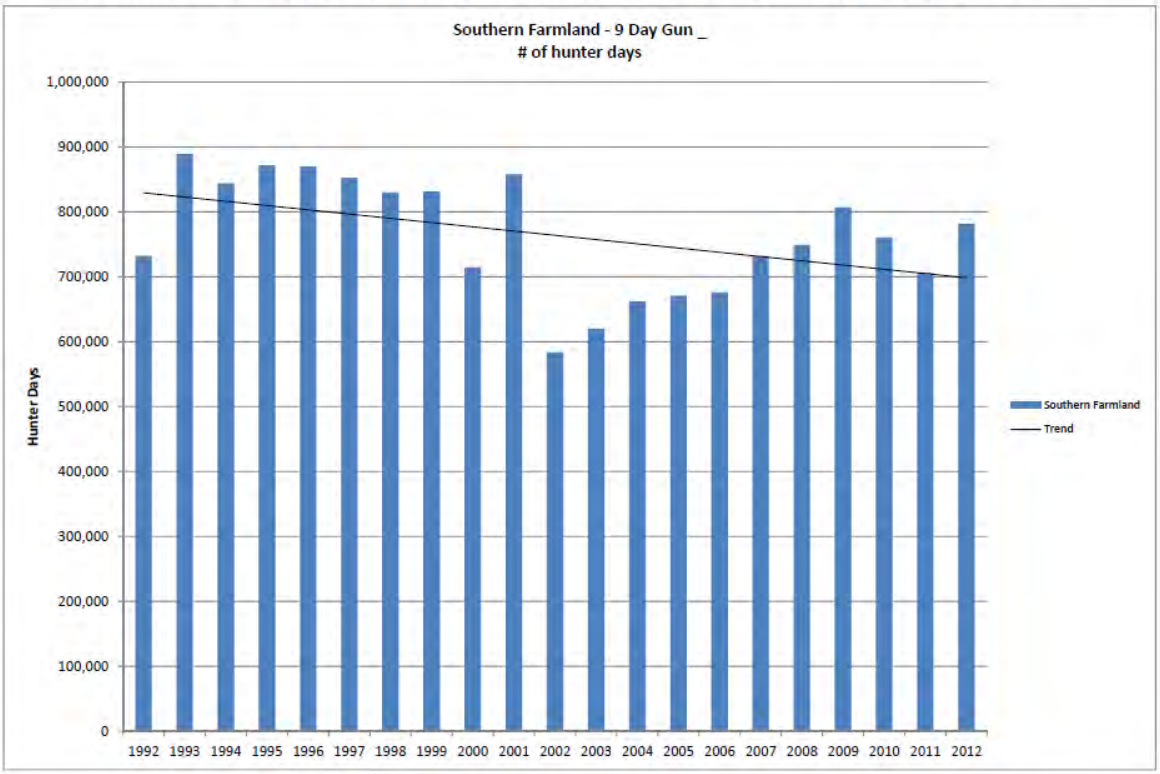
Data derived from a mailed survey of gun deer hunters

Number of Hunters Days During the 9-Day Gun Deer Season



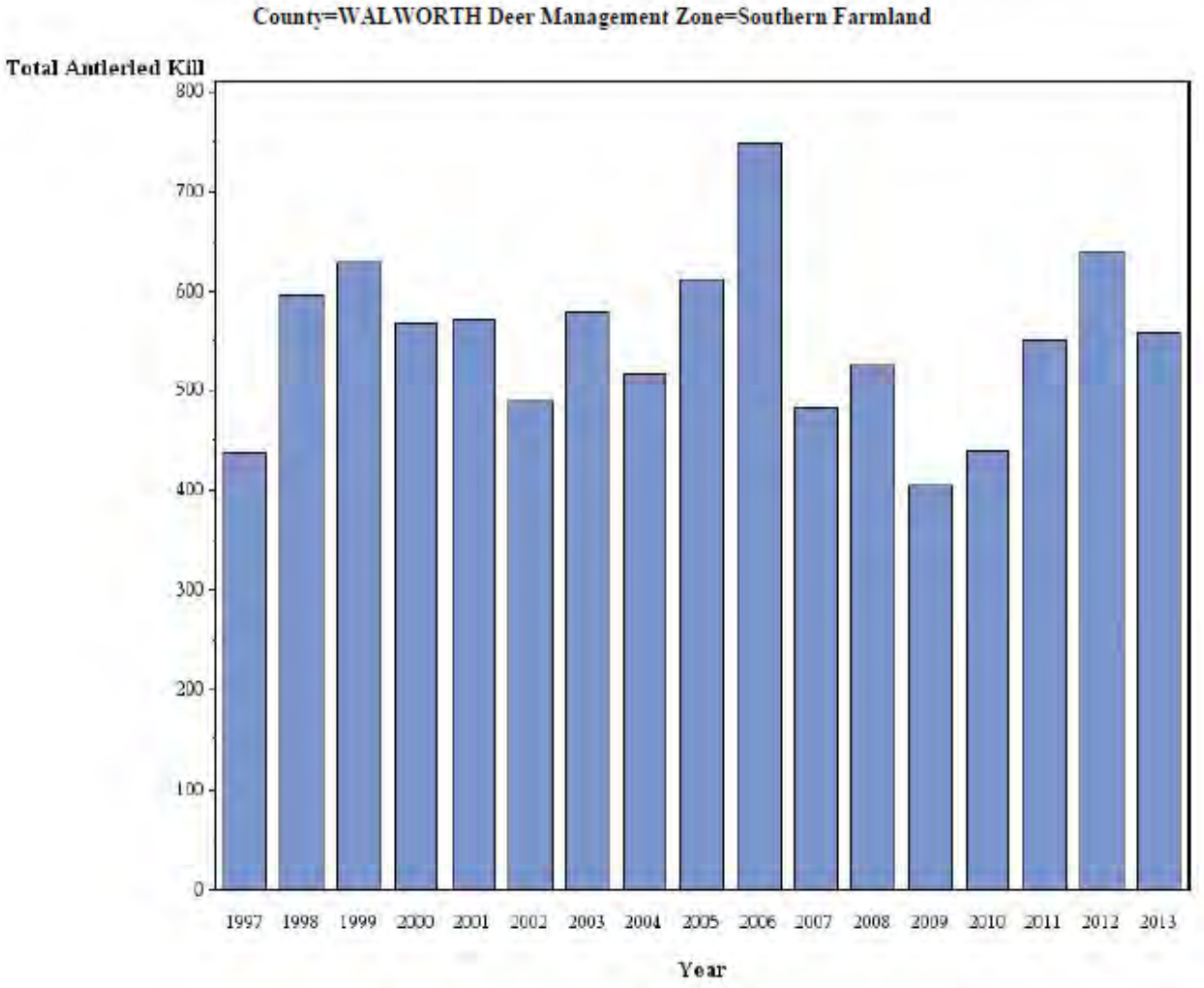
Data derived from a mailed survey of gun deer hunters

Number of Hunters Days During the 9-Day Gun Deer Season



Data derived from a mailed survey of gun deer hunters

Antlered Deer Kill (Gun + Archery) by County and Deer Management Zone 1997-2013



Deer Population Metrics

- Abundance
- Fawn:doe ratios
- Yearling antlers

Metric Type: Abundance estimates

Background: Deer abundance is managed through the harvest of antlerless deer; specifically the percentage of antlerless deer that are harvested each year (harvest rate). For instance, in farmland management zones, harvesting approximately 25% of the antlerless deer will stabilize the population, while the population will tend to grow with a lower harvest rate and decrease with a higher harvest rate. For this reason, population estimates are important for setting antlerless quotas.

Additionally, information on deer population size and trend is important for interpreting other measures of deer condition and impacts. Consider the following example: a metric of deer impacts is increasing over time (say crop damage). The response in this situation may be to increase antlerless harvest, to lessen the impact. If however, at the same time, we observed that deer abundance was not increasing, then we would conclude that something other than deer abundance was driving the increase in the damage metric, and increased antlerless harvest may not be necessary. Deer abundance is important for putting other deer metrics into perspective.

The Wisconsin DNR annually estimates the size of deer populations in each deer management unit. Deer population estimates may be expressed in terms of abundance or density. Abundance estimates are the total number of deer estimated for an entire unit. Density can be calculated by dividing the abundance estimate by the area (square miles) within the unit. Density estimates are useful for comparing population estimates among deer management units because they standardize abundance estimates by taking into account the difference in size of deer management units.

Deer population estimates are made for two time periods, a fall or prehunt estimate and an overwinter or posthunt estimate. Posthunt population estimates provide the starting point for annual determinations of antlerless harvest quotas and permit levels.

Collection and analysis methods: Wildlife managers use a combination of information to derive population estimates for each deer management unit. Mandatory registration of every deer harvested during the hunting season is the backbone of the state's deer monitoring system. When hunters register their deer, information is collected on the date and place of harvest and the sex of the deer. The number of bucks harvested in each management unit is the starting place for most deer population estimates. The nine-day gun deer season traditionally begins the Saturday before Thanksgiving. With uniform seasons, hunting patterns usually change little from year to year. The proportion of the adult buck population taken by hunters is therefore relatively uniform from one year to the next. Under such stable conditions, managers have found that buck harvest trends closely track deer population trends.

Mandatory registration also allows wildlife biologists to check the ages of harvested deer at some registration stations around the state. About 22,400 deer were aged in 2012 and about 19,600 were aged in 2013. In 2013, aging was conducted at 113 locations throughout the state and involved more than 170 agers. This aging data provides important information on the proportion of the buck population that is harvested as well as the sex composition of the fall deer population.

Each August and September, DNR employees and volunteers across the state keep records of the number of does, fawns, and bucks they see. The ratio of fawns to does provides an index to current reproductive rates and is an essential component in the formula used to estimate herd size.

Information from harvest registration and aging, along with other data, is used in a mathematical population model called the Sex-Age-Kill (SAK) formula. Population estimates for most deer management units in the state are calculated using the SAK formula. Information on the age composition of the buck harvest is used to estimate the percentage of adult bucks killed during the legal hunt. The

SAK formula combines this estimate with information on the size of the buck harvest to estimate the size of the pre-hunt adult buck population. The adult buck population is then expanded to the entire population using estimates of the number of does per buck and the number of fawns per doe in the pre-hunt population. The overwinter deer population for each deer management unit is determined by subtracting the harvest from the pre-hunt population estimate.

In the southern third of Wisconsin, where management to control chronic wasting disease altered deer season structure and harvest regulations, wildlife managers have flown aerial surveys with fixed-wing aircraft during winter when snow cover facilitates observing deer. These surveys provide a measure of population trend. More than 4,000 miles have been flown annually since 2009. Information from these surveys has been combined with data on harvest size and sex and age composition in another type of population model, called an accounting model, to yield estimates of post-hunt population size. Similar accounting models were also used for a number of years in most units in the central farmland zone where earn-a-buck regulations during 2004-2008 altered the proportion of the adult buck population harvested by hunters.

The accounting model simulates changes over time in the number of deer in each sex- and age-class of the population. The model cycles through the major biological events within a year, adding fawn production, and subtracting mortality during summer, fall and winter. This process is then repeated for multiple years. Accounting models use much of the same data as does the Sex-Age-Kill formula but makes different assumptions about these data. Effective use of accounting models requires some independent data on population size or trend. Population trend data from winter aerial surveys or prior population estimates from SAK estimates have been used to calibrate accounting models.

Using the metric: Variation in deer abundance across the state largely reflects variation in the quantity and quality of habitat together with the influences of climate. The abundance of woodlands interspersed with agriculture throughout the much of central and southwestern Wisconsin results in high quality deer habitat. This together with relatively mild winters in these regions in most years facilitates higher deer densities than in other part of the state.

Fall deer population estimates (Figure 1) are based to a large degree on the number of antlered bucks harvested in each deer management unit. Buck harvest density (Figure 2) in 2013 varied among deer management units from less than 1 to more than 6 bucks harvested per square mile of land area. Fall deer densities in 2013 (Figure 3) varied from 6 to more than 60 deer per square mile of land area. Deer management units with the highest fall densities were mostly in the east-central, west-central, and southwestern parts of the state. Units with the lowest fall deer densities were mostly in north-central, northeastern, and southeastern Wisconsin. Overwinter deer population estimates (Figure 4) are derived from the fall population estimates and the total registered harvest. Overwinter deer densities in 2013 (Figure 5) varied from about 6 to about 46 deer per square mile of deer range.

Deer population estimates from a given area can be compared over time to determine the population trend. Graphs have been provided that show annual estimates of overwinter population size for each deer management unit (Appendix 1). Three-year running averages of population size have been calculated to help illustrate overall population trend.

Limitations and precautions: While the length of the November gun season has not changed in most of the state for many years and hunting patterns and the proportion of the adult buck population taken by hunters is relatively stable, there is some year-to-year variation in buck harvest rates that affect population estimates based on buck harvests. Some of this variation is caused by shifts in opening dates of the November gun season (earliest date 17th, latest date 23rd) in relationship to the timing of peak breeding activity. Additionally weather variation during the 9-day gun season can alter deer and hunter behavior.

Consequently, some of the annual variation in deer abundance estimates is the result in variation in buck harvest rates.

Sample sizes for some of the parameters of the Sex-Age-Kill formula (e.g., yearling buck percentages, yearling doe percentages and fawn:doe ratios) are limited due to personnel limitations. Consequently, it is necessary to pool some data over multiple management units and/or years to produce annual deer population estimates for all management units.

It is important to keep in mind that density estimates for deer management units are based largely on the number of antlered bucks harvested in the unit. The resulting density estimates are averages for the entire unit and may not accurately reflect local deer density. There can be considerable local variation in density within deer management units due to differences in deer habitat quality and local hunting pressure.

Future needs: The Department continues to look for alternative ways to cost-effectively monitor changes in deer population size in deer management units. A better understanding of factors affecting buck harvest rates may improve the accuracy of harvest-based population estimates. Additionally, it will be important to develop ways to cost-effectively collect harvest age data once eRegistration is fully implemented.

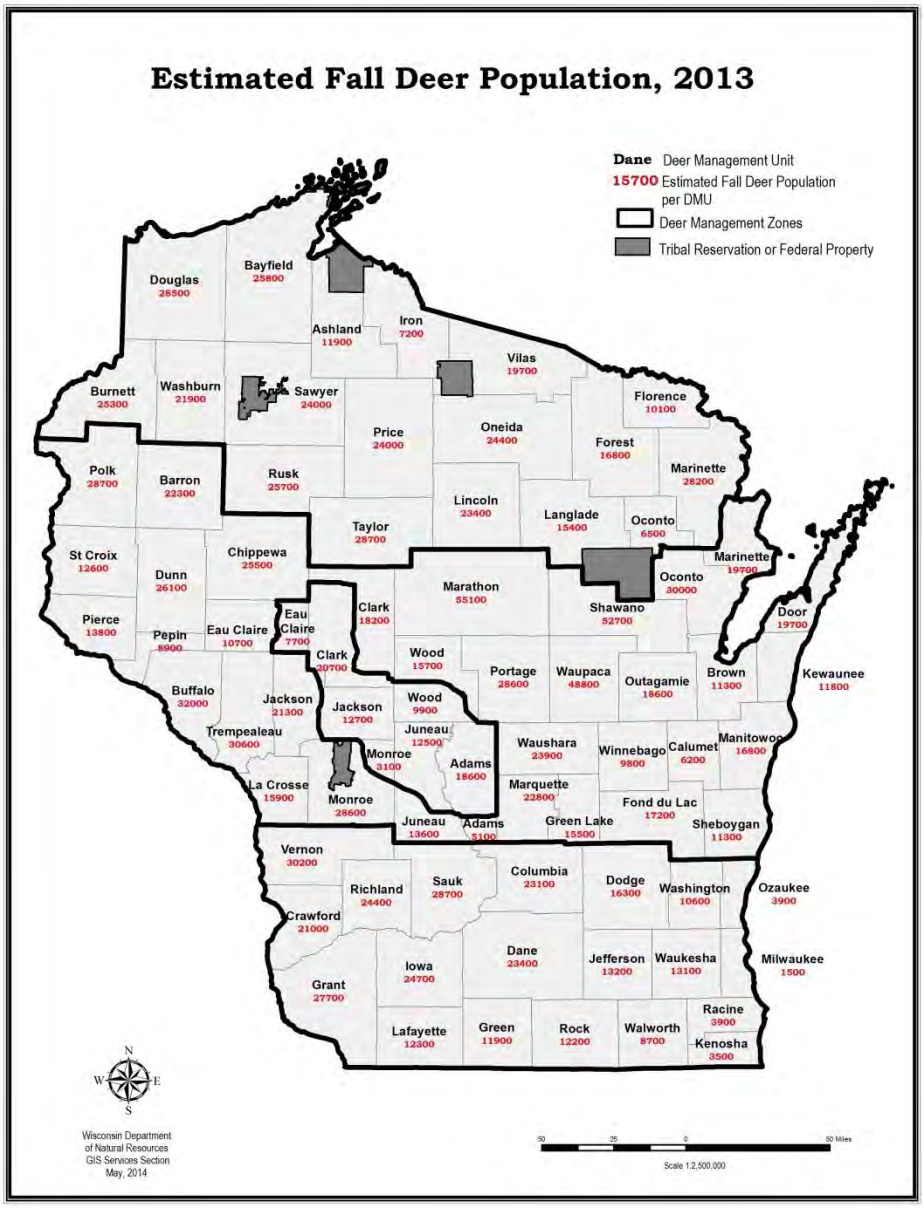


Figure 1. Fall 2013 deer population estimates for deer management units.

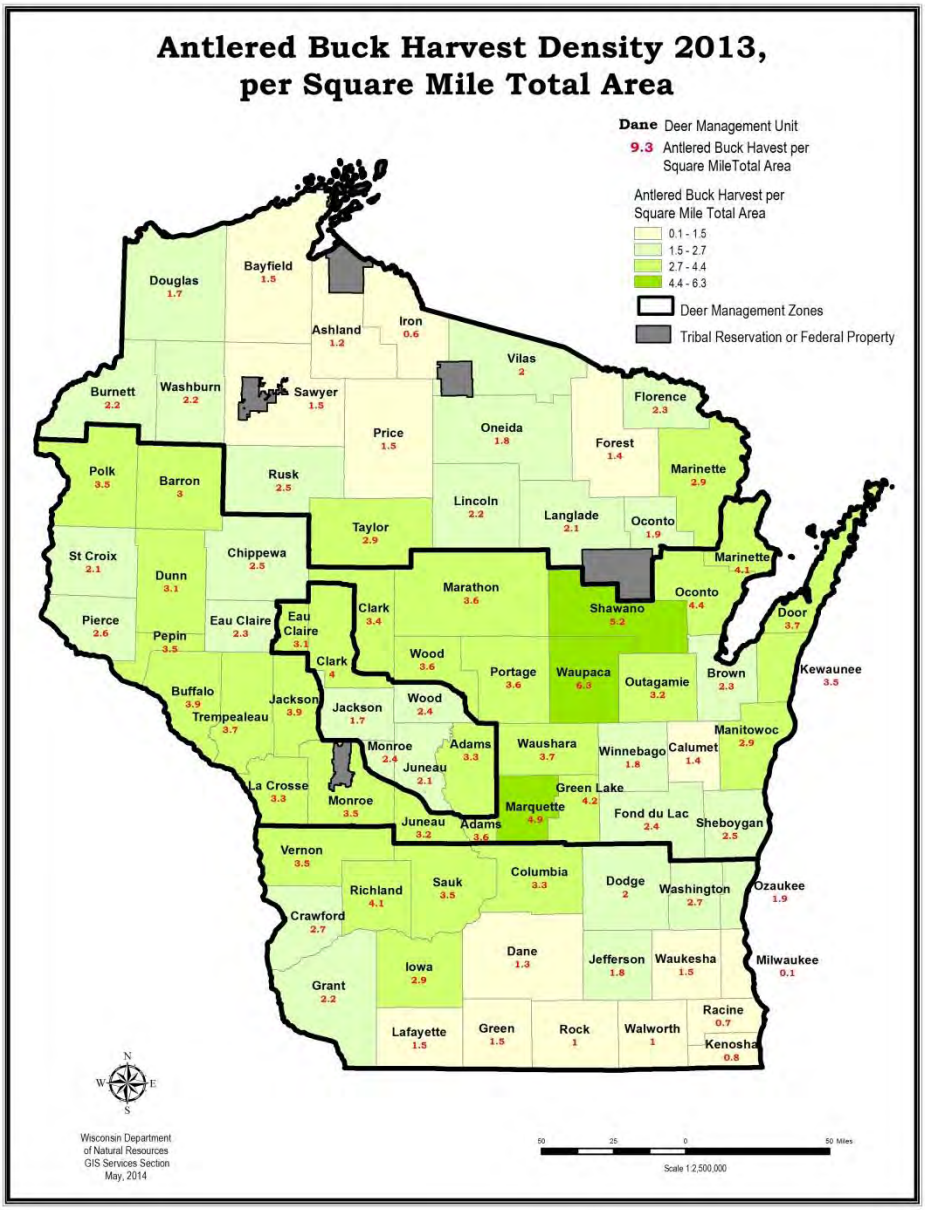


Figure 2. Fall 2013 antlered buck harvest density (number of antlered bucks harvested/sq. mile of land area) by deer management unit.

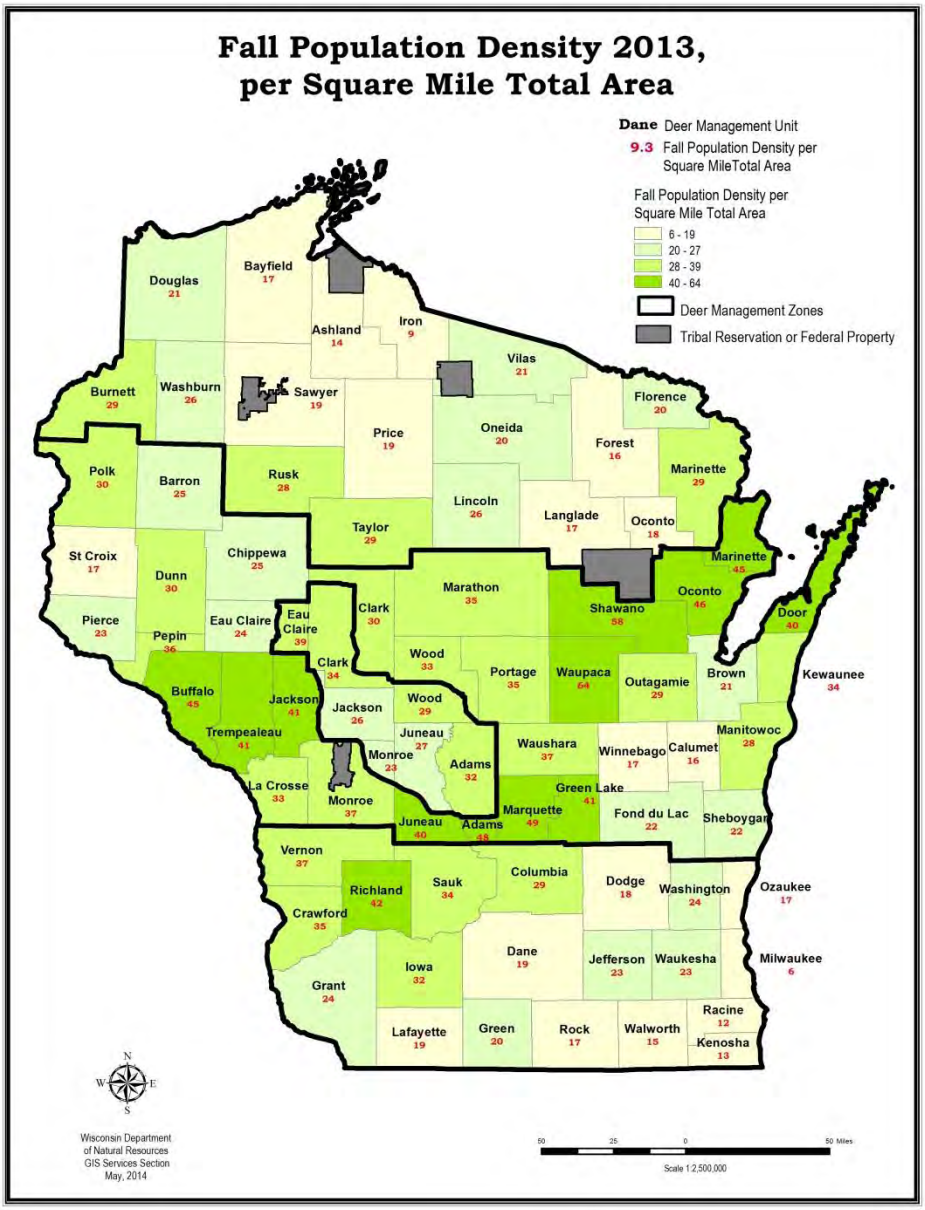


Figure 3. Fall 2013 deer density estimates (number of deer/sq. mile of land area) by deer management unit.

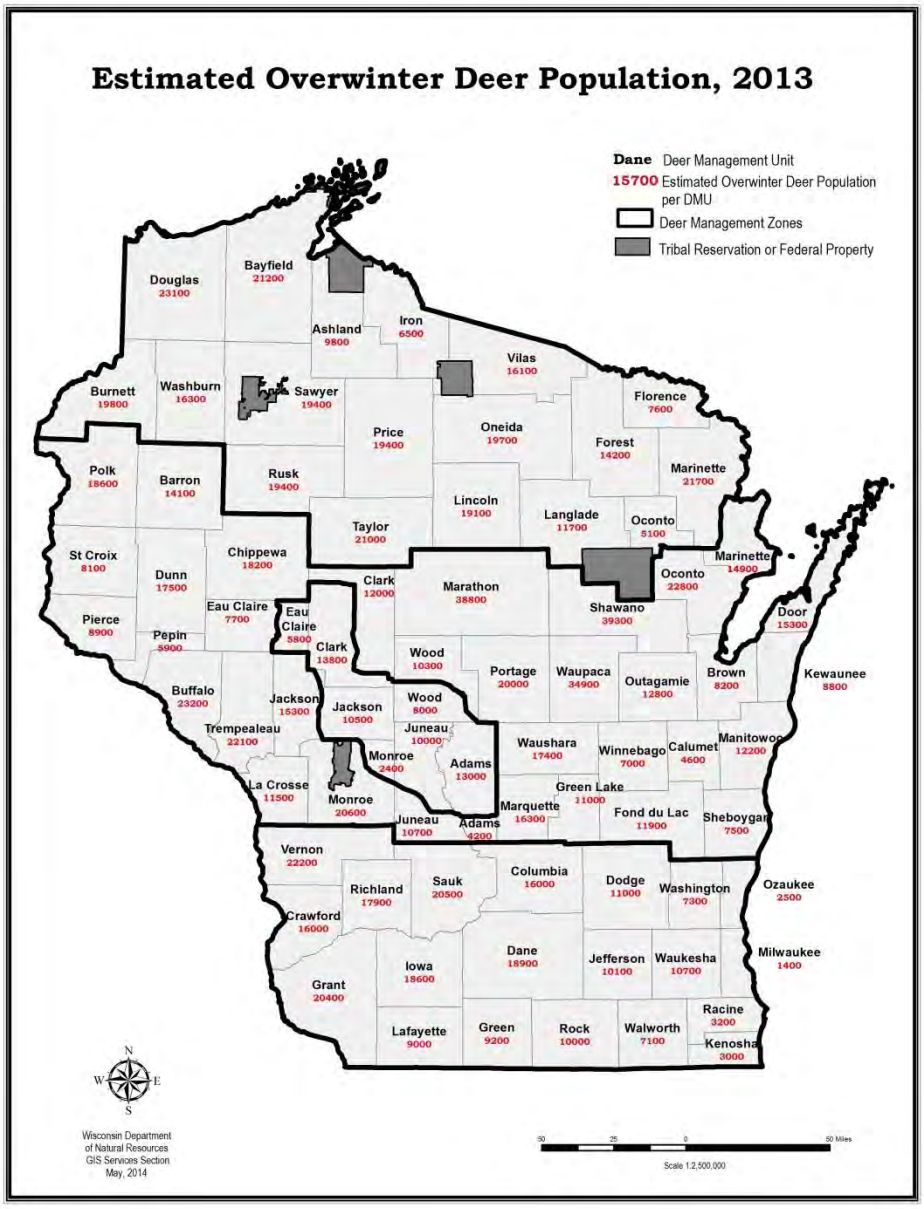


Figure 4. Overwinter 2013-14 deer population estimates by deer management unit.

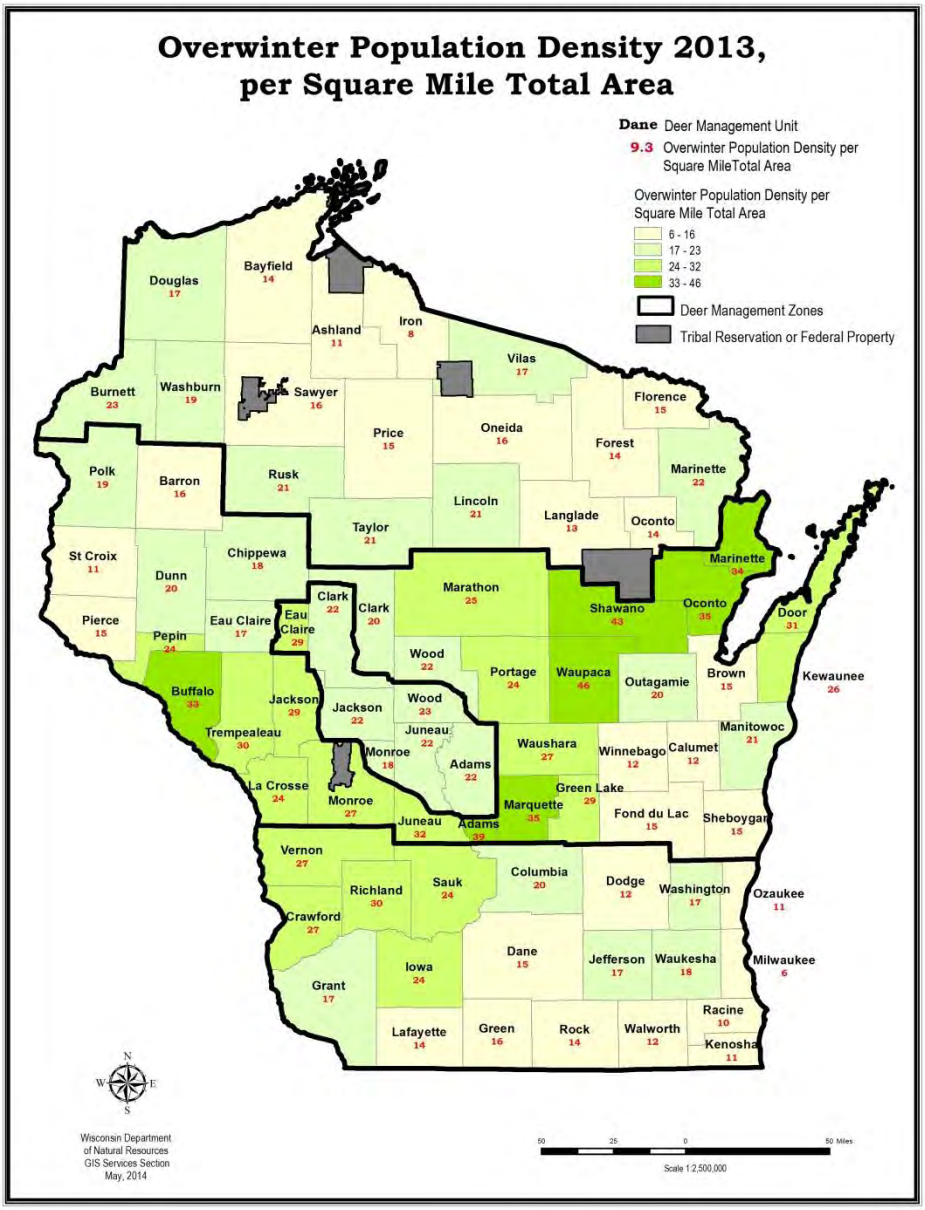


Figure 5. Overwinter 2013-14 deer density estimates (number of deer/sq. mile of land area) by deer management unit.

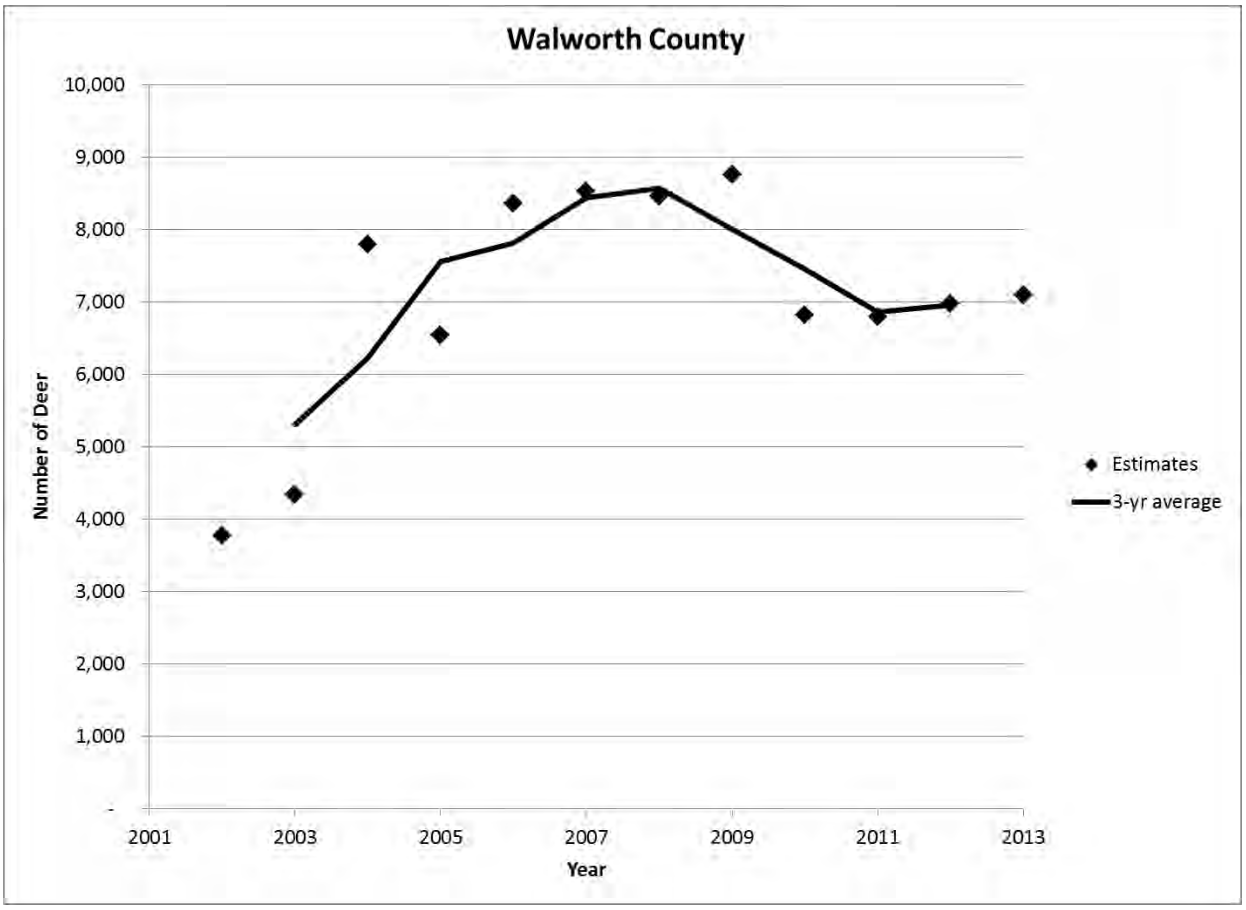


Figure 1: Post-hunt population estimates for counties/new management areas, 2002 - 2013.

Metric Type: Fawn:doe Ratios

Background: Fawn:doe ratios (FDRs) are often used for monitoring deer population status because they provide information about fawn production and survival. Both fawn production and survival during the first few weeks after birth are strongly influenced by the nutritional condition of the population. Fawn production is the product of age-specific pregnancy rates, the number of fetuses per pregnant doe and age composition of the population. Both pregnancy rates and the number of fetuses per doe are strongly influenced by food availability which is in turn is affected by the size of the deer population and the quality of the habitat. In addition, survival of new born fawns is often related to the nutritional status of the doe. Does with inadequate fat reserves and/or available forage will often abandon their fawns. Survival of new born fawns is also affected by predation. In Wisconsin, bears, coyotes, and bobcats have been documented to prey on new born fawns.

In the forested regions of Wisconsin, FRDs and yearling antler development show similar patterns of annual variation. Both metrics trend appear to reflect variation in the severity of winter weather. The nutritional factors that impact fawn production and survival also affect body growth and antler development.

Collection and analysis methods: The Wisconsin Department of Natural Resources (WDNR) has used roadside surveys for estimating summer FDRs since the 1960s. WDNR and cooperating U.S. Forest Service and U.S. Fish and Wildlife Service personnel record deer observations in August and September during normal duty travels. Deer observed during daylight hours were recorded by month and management unit. The total numbers of fawns and does reported during August and September was used to calculate summer FDRs.

FDR data have historically been reported by deer management unit. Due to sampling limitations, FDRs were previously only estimated for 13 groups of management units across the state. County- and zone-specific samples were approximated by pooling fawn and doe observations from units that overlapped counties. For example, the Adams County/Forest Zone sample was composed of fawns and does observed in units 53 and 54A even though some of these deer may have been observed outside of Adams County.

Annual sample sizes at the county/zone level were insufficient to permit meaningful analysis for many counties. Therefore county-level data were grouped into 9 county groupings* (Northwestern Forest, Northcentral Forest, Northeastern Forest, Western Farmland, Central Forest, Central Farmland, Lake Michigan Farmland, Southwestern Farmland, and Southeastern Farmland). Graphs were prepared that show annual estimates of FDRs and 3-year running averages for each of these 9 county groupings. The geographic variation in FDRs was illustrated by calculating estimates of 5-year average FDRs for county- and zone-specific areas (Figure 1).

The WDNR initiated Operation Deer Watch (ODW) in 2010 to increase public involvement in Wisconsin's deer management program while supplementing the Department's fawn/doe observation database. ODW invites the public to opportunistically record deer observations during August and September. Observations were submitted through a web-based interface that provided participants survey instructions identical to those used by agency personnel. Due to the short duration of the ODW survey and substantial variation in public participation with this survey only data from agency personnel are reported here.

Using the metric: Average FDRs vary across Wisconsin, generally lower in forested regions than in farmland regions (Figure 1). Lower average FDRs were also noted for some southwestern counties. Low FDRs may reflect deer population densities that are closer to biological carrying capacity than in many of

the farmland counties. Low FDRs in some counties may also reflect higher levels of predation on new born fawns.

Year-to-year variation in FDRs may be related in part to variation in winter severity. Long-term trends in FDRs can reflect changes in habitat quality or deer abundance relative to biological carrying capacity. Alternatively, long-term trends in FRDs may also be influenced by changes in the predator community. Several of the county groupings show evidence of long-term declines in FDRs.

Limitations and precautions: No un-biased method has been developed to measure the number of fawns per doe in late summer or fall deer populations. However, trends in roadside observations of does and fawns, especially in forested regions, have tended to match expectations based on other measures of nutritional condition of the herd and severity of winter weather.

The precision (repeatability) of FDRs is a function of the number of does and fawns observed. At the county level sample sizes have often been relatively low. Annual county-specific estimates of FDRs were not calculated if fewer than 20 does were observed. Year- and county-specific estimates based on samples of fewer than 100 does should be interpreted with caution. Because of sampling limitations, county-specific trends in FDRs may not be reliable.

Future needs: A department team will be assessing whether there are more cost-effective ways to estimate fawn:doe ratio data. Part of this assessment will be an analysis of the utility of deer observations from the public that are submitted through Operation Deer Watch.

Additional background materials related to this metric:

**County Groupings Used to Summarize Yearling Antler Development and Fawn:Doe Ratios*

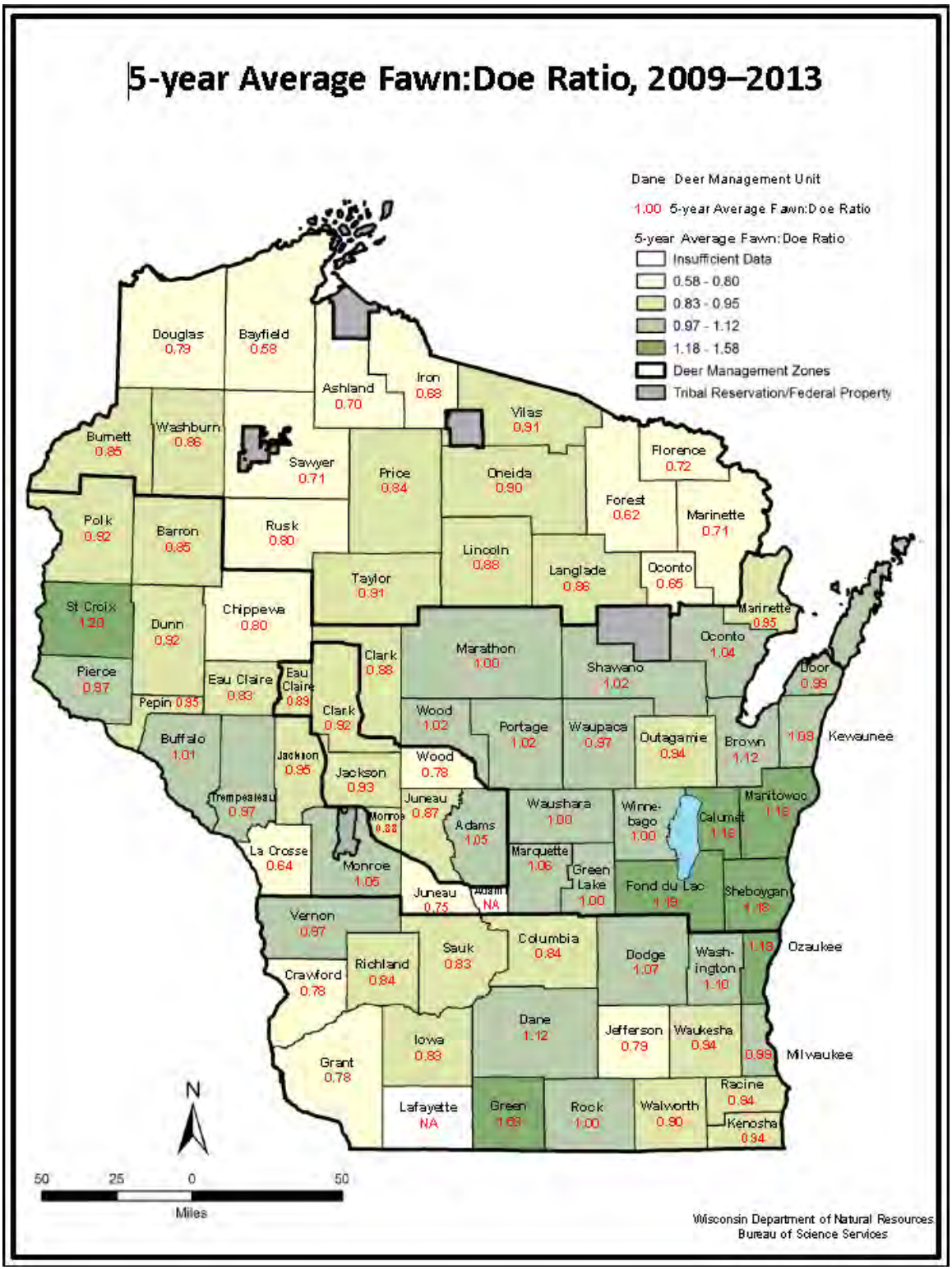


Figure 1. Five-year average fawn:doe ratios for deer management units, 2009-2013. Fawn:doe ratios were estimated from observations of deer by agency personnel during routine duty travel during August and September.

County Groupings Used to Summarize Yearling Antler Development and Fawn:Doe Ratios

Yearling antler development and fawn:doe ratios were summarized using groups of county deer management units. This is because some counties do not have a sufficient number of yearling antler records or an adequate number of doe sightings to provide reliable county-based averages. To address this problem, groups of county deer management units were created and the two metrics were summarized based on the observations within these groups. County deer management units were grouped based on location (whether in forested zones or farmland zones), habitat characteristics, and deer demography. We tried to make the groups small enough so that they may be applicable to the representative counties, but at the same time large enough so that an adequate number of observations could be summarized.

Forest Groups

Northwest Forest

Bayfield, Burnett, Douglas, Rusk, Sawyer, and Washburn

Northcentral Forest

Ashland, Iron, Langlade, Lincoln, Oneida, Price, Taylor, and Vilas

Northeast Forest

Florence, Forest, and the Forest Zone parts of Marinette and Oconto

Central Forest

The Forest Zone parts Adams, Clark, Eau Claire, Jackson, Juneau, Monroe, and Wood

Farmland Groups

Western Farmland

Barron, Buffalo, Chippewa, Dunn, La Crosse, Pepin, Pierce, Polk, St. Croix, Trempealeau, and the Farmland parts of Monroe, Eau Claire, Jackson, Juneau, and Adams

Central Farmland

Green Lake, Marathon, Marquette, Outagamie, Portage, Shawano, Waupaca, Waushara, and the Farmland parts of Clark, Marinette, Oconto, and Wood

Lake Michigan Farmland

Brown, Calumet, Door, Fond du Lac, Kewaunee, Manitowoc, Sheboygan, Winnebago

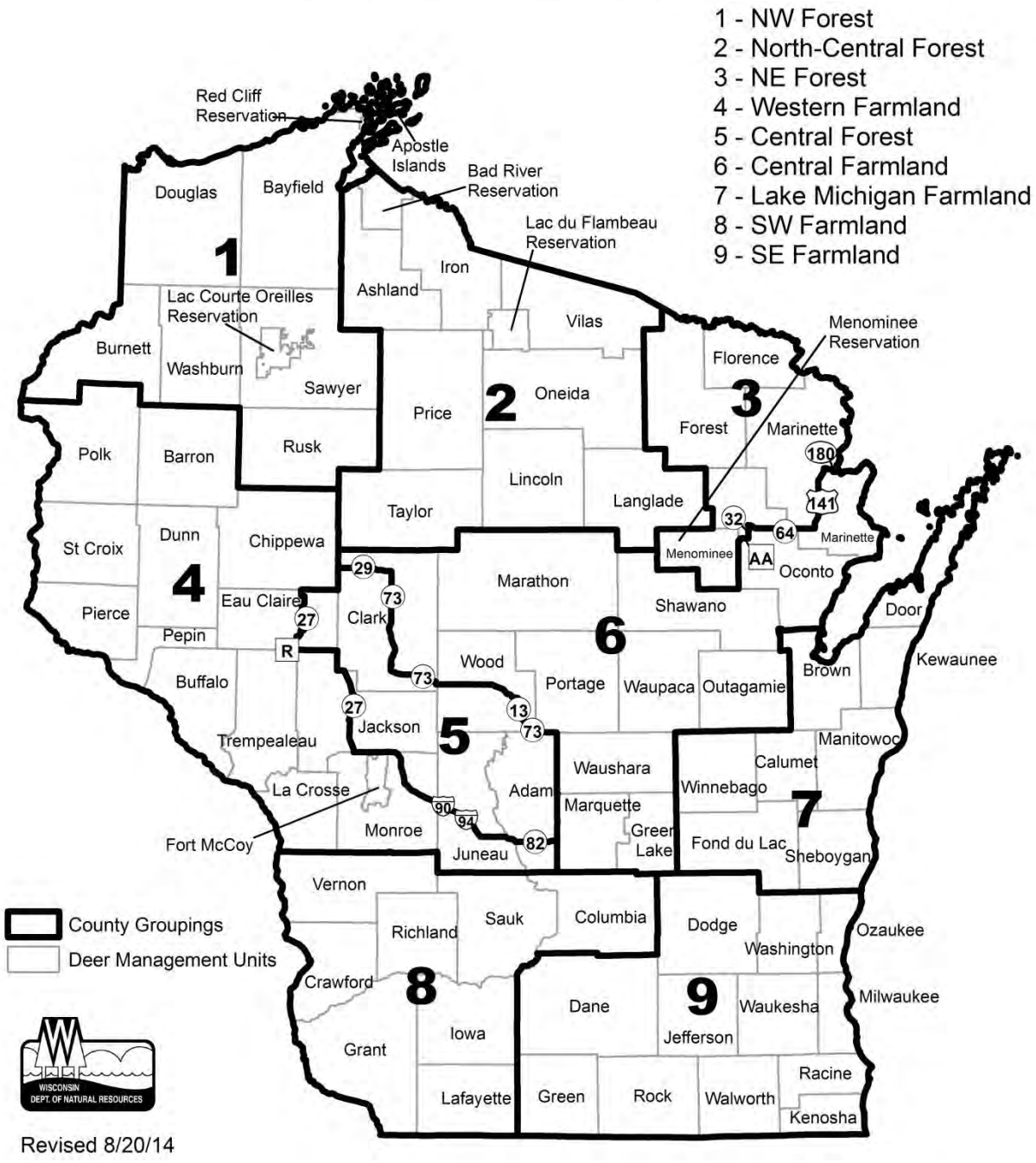
Southwest Farmland

Columbia, Crawford, Grant, Iowa, Lafayette, Richland, Sauk, Vernon

Southeast Farmland

Dane, Dodge, Green, Jefferson, Kenosha, Milwaukee, Ozaukee, Racine, Rock, Walworth, Washington, and Waukesha

County Groupings Used to Summarize Fawn:Doe Ratio



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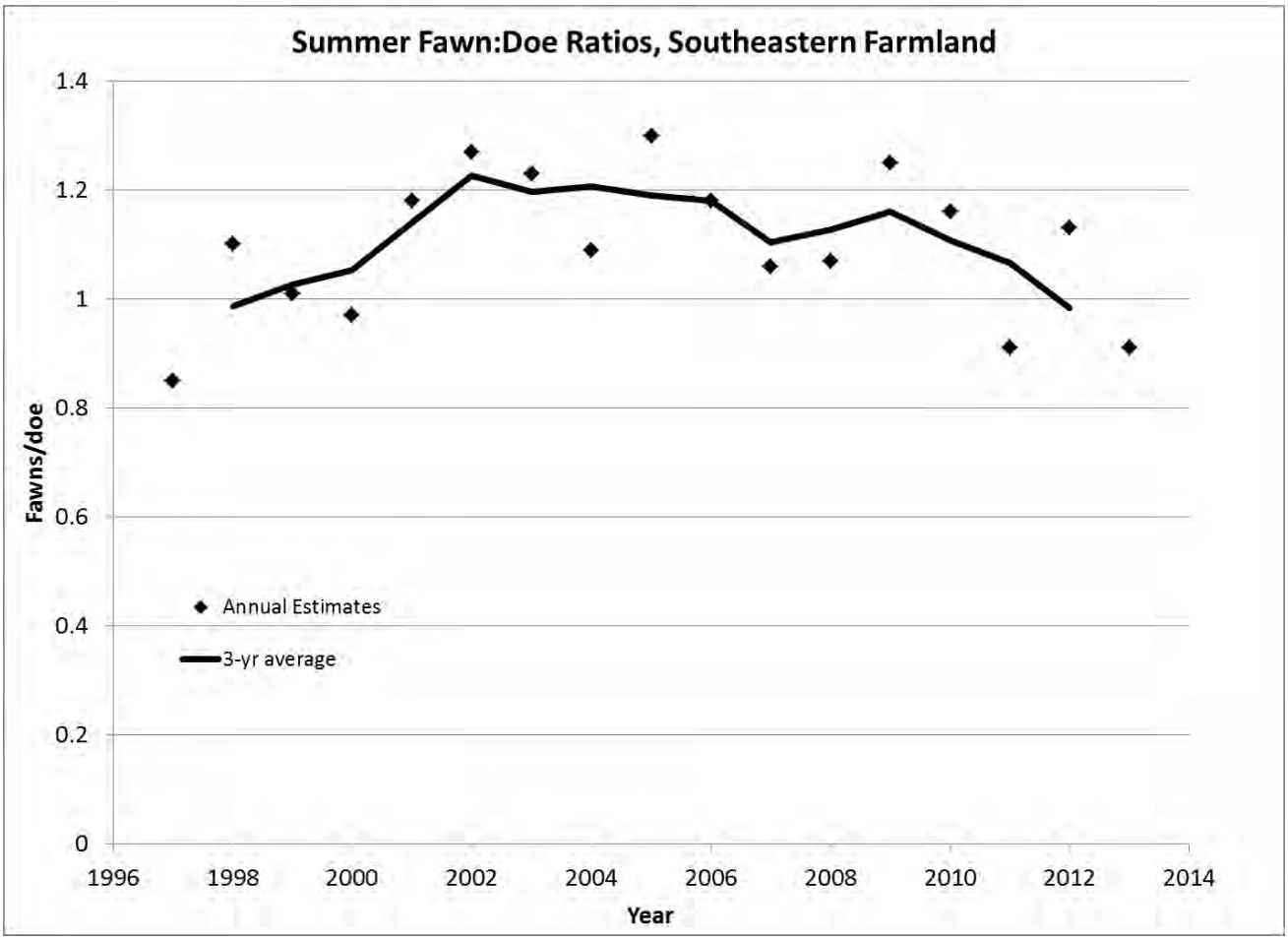

Figure 2: Fawn:doe ratios from summer deer observations by agency personnel during August and September. Fawn:doe ratios were calculated if 20 or more does were observed.

Metric Type: Yearling Antler Development

Background: Antler size of yearling bucks is a sensitive indicator of nutritional condition. Yearling deer invest heavily in body growth during the spring and summer. If nutrients are limited, body growth takes precedence over antler growth. Therefore, antler size of yearling males is a reliable barometer of the nutritional status of deer populations, which in turn, reflects the quality of the habitat (including climatic conditions) and the density of the population. Yearling bucks in good nutritional condition typically produce four to six-point racks and eight-point racks are not uncommon. In contrast, yearlings in poor habitat rarely have more than spike antlers (two points) and many have "sublegal" antlers that are less than 3 inches long. In severe cases of malnutrition, yearlings may completely fail to develop bony antlers, showing only "buttons" normally seen on male fawns.

The nutritional condition of a deer population is determined by the biological carrying capacity of the habitat and the density of deer. Biological carrying capacity is a function of the quantity and quality of the vegetation and the climate of the region. In Wisconsin farmlands, agricultural crops provide an abundance of foods and the winters rarely stress deer. In contrast, the northern forests produce substantially less nutritious food within reach of deer and the winters are often severe.

Annual changes in yearling antler size can reflect the impact of winter severity on nutritional condition, and long-term trends can reflect changes in forest habitat or deer abundance relative to biological carrying capacity. Importantly, the nutritional factors that impact antler growth also affect fawn rearing success and body growth.

Collection and analysis methods: Mandatory registration has allowed wildlife biologists to check antler characteristics of yearling bucks while aging deer at registration stations around the state. Wildlife biologists have recorded the percentage of yearling bucks with forked antlers (at least one antler with a 1" or longer branch off of the main beam). During the past 20 years, biologists have examined from 4,000 to 11,000 yearling bucks each year from throughout the state.

Data have historically been collected by deer management unit. County- and zone-specific samples were approximated by pooling data from units that overlapped counties. For example, the Adams County/Forest Zone sample was composed of yearling bucks harvested in units 53 and 54A even though some of the yearlings from these units may have been harvested outside of Adams County.

Annual sample sizes at the county/zone level were insufficient to permit meaningful analysis for many counties. Therefore county-level data were grouped into 9 county groupings* (Northwestern Forest, Northcentral Forest, Northeastern Forest, Western Farmland, Central Forest, Central Farmland, Lake Michigan Farmland, Southwestern Farmland, and Southeastern Farmland). Graphs were prepared that show annual estimates of the percentage of yearling bucks with forked antlers and 3-year running averages for each of these 9 county groupings. The geographic variation in yearling antler development was illustrated by calculating estimates of 5-year average percentages of yearling bucks with forked antlers for county- and zone-specific areas (Figure 1).

Using the metric: The percentage of yearling bucks with forked antlers varies considerably among regions of Wisconsin. In the farmlands, nearly 90% of yearlings have forked antlers, suggesting that they are in good nutritional condition. In contrast, only about 57% of yearlings in the Northcentral Forest county group and about 60% in the Central Forest county group have forked antlers in an average year. The poorer antler development in the forested regions is an indication that average deer densities in these regions are closer to biological carrying capacity than in the farmlands.

Within the Northern and Central Forests there has been substantial year-to-year variation in yearling antler development. In the past 17 years, the percentage of yearlings in the Northwestern Forest county group with forked antlers has been as low as 41% and as high as 73%. Much of the annual variation can be explained by differences in the severity of winter weather. The farmland regions showed much less annual variation in size of yearling antlers than in the forests.

Long-term trends in the percentage of yearlings with forked antlers suggest changes in the interaction between deer populations and biological carrying capacity. Long-term declines in the metric may indicate increasing nutritional stress while long-term increases in the metric may reflect better food availability.

Limitations and precautions: Due to personnel limitations the number of yearling bucks examined has been insufficient in some areas to provide valid estimates in some years. Therefore county-level trends in the metric should be interpreted with caution. Sample sizes were limited in a number of southwestern Wisconsin counties because CWD sampling has been a higher priority for staff than deer aging.

Future needs: It will be important to develop ways to cost-effectively assess yearling antler development once eRegistration is fully implemented.

Additional background materials related to this metric:

**County Groupings Used to Summarize Yearling Antler Development and Fawn:Doe Ratios*

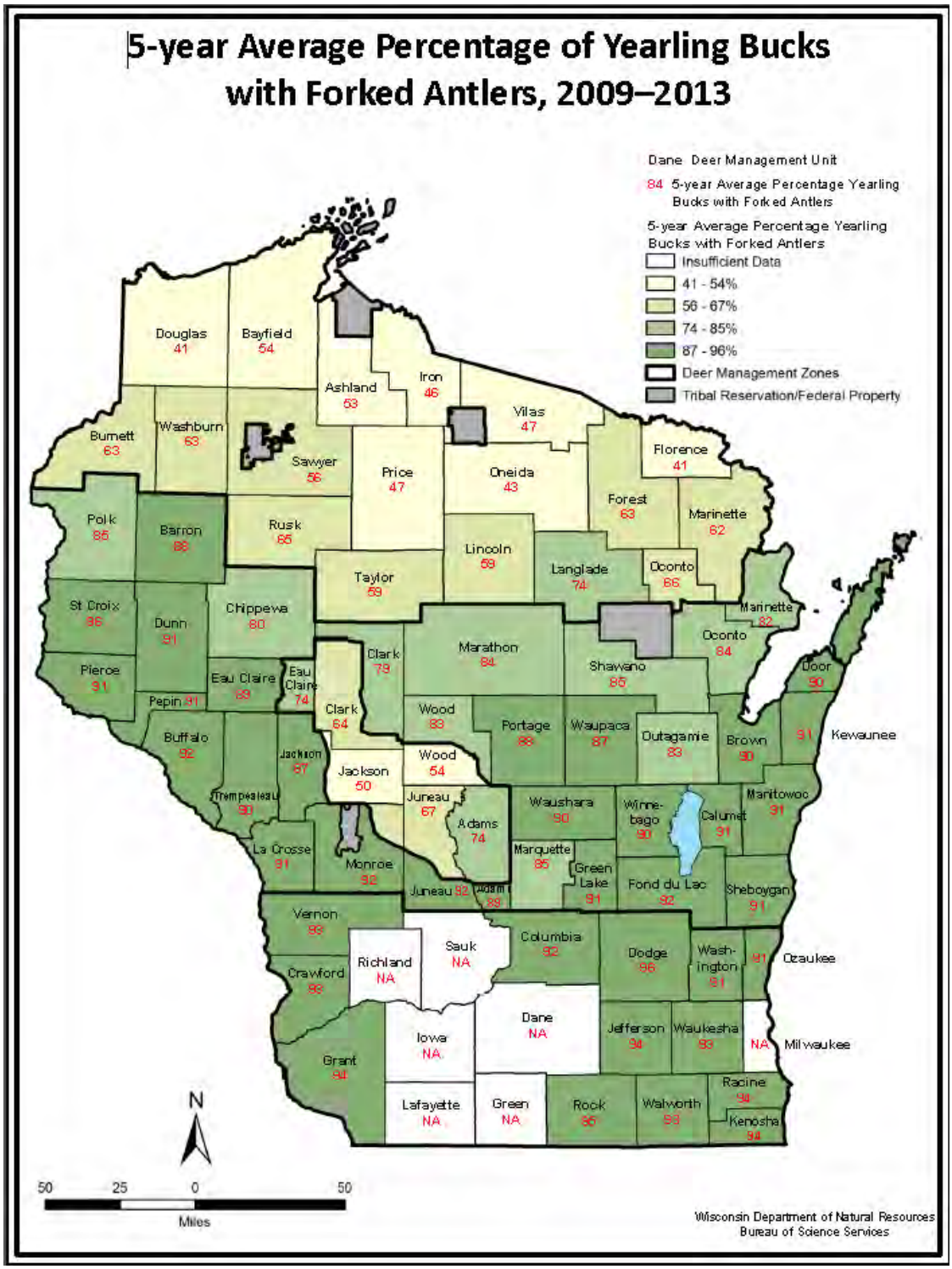

Figure 1. Five-year average percentage of yearling bucks with forked antlers, 2009-2013.

County Groupings Used to Summarize Yearling Antler Development and Fawn:Doe Ratios

Yearling antler development and fawn:doe ratios were summarized using groups of county deer management units. This is because some counties do not have a sufficient number of yearling antler records or an adequate number of doe sightings to provide reliable county-based averages. To address this problem, groups of county deer management units were created and the two metrics were summarized based on the observations within these groups. County deer management units were grouped based on location (whether in forested zones or farmland zones), habitat characteristics, and deer demography. We tried to make the groups small enough so that they may be applicable to the representative counties, but at the same time large enough so that an adequate number of observations could be summarized.

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Green Lake, Marathon, Marquette, Outagamie, Portage, Shawano, Waupaca, Waushara, and the Farmland parts of Clark, Marinette, Oconto, and Wood

Lake Michigan Farmland

Brown, Calumet, Door, Fond du Lac, Kewaunee, Manitowoc, Sheboygan, Winnebago

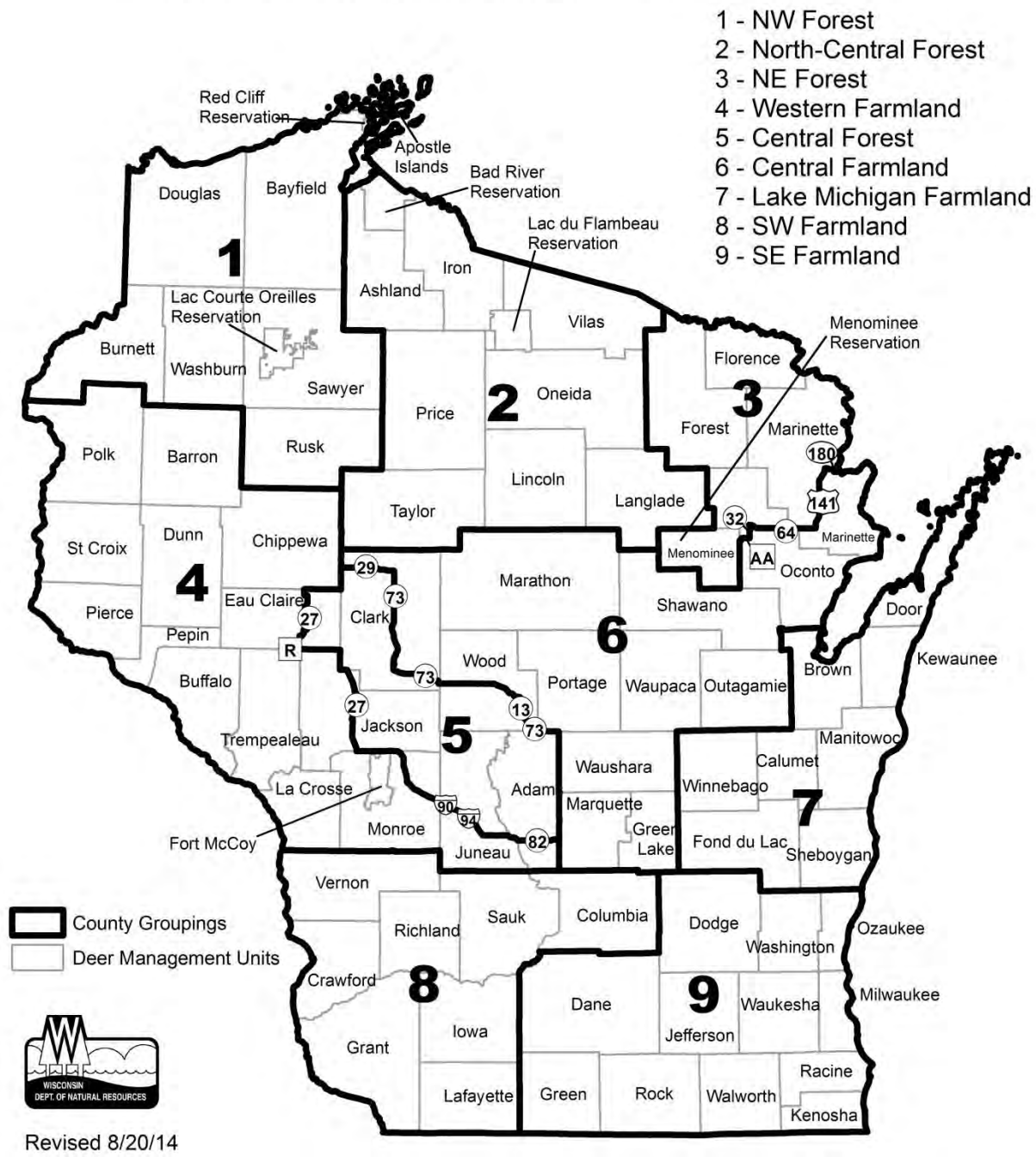
Southwest Farmland

Columbia, Crawford, Grant, Iowa, Lafayette, Richland, Sauk, Vernon

Southeast Farmland

Dane, Dodge, Green, Jefferson, Kenosha, Milwaukee, Ozaukee, Racine, Rock, Walworth, Washington, and Waukesha

County Groupings Used to Summarize Yearling Antler Development



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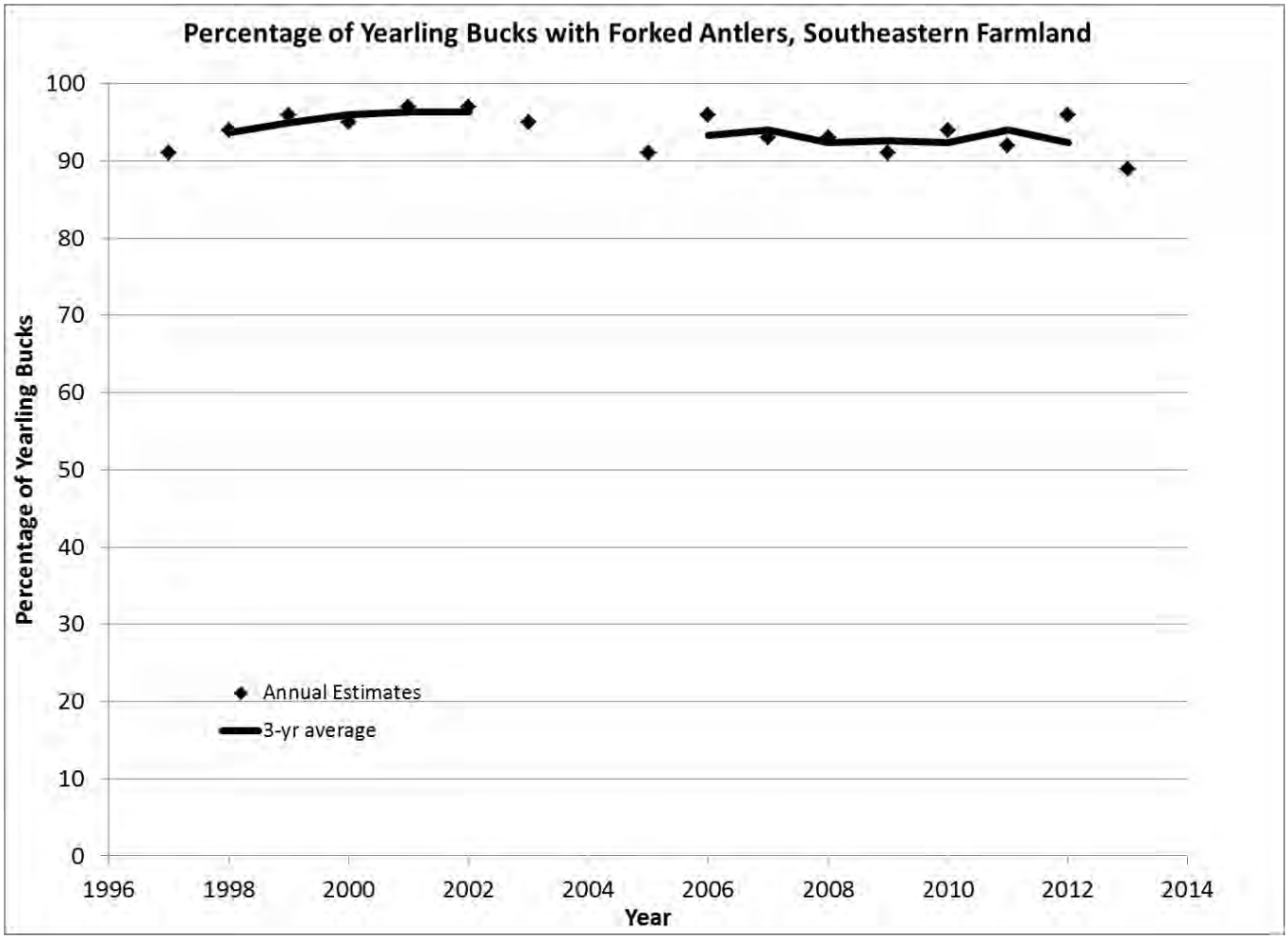


Figure 3: Percentage of yearling bucks with forked antlers. Percentages were calculated if 50 or more yearling bucks were aged.

Herd Health Metrics

Metric Type: Deer reproduction and nutritional condition

Background: The DNR and partners conduct summer observations of fawn:doe ratios, which provides valuable information on recruitment and population growth. One limitation of fawn:doe ratio data is that we don't know if changes are due to changes in fawn survival or to changes in pregnancy rates and litter size. Therefore, knowing pregnancy rates and litter sizes would help us understand the changes in population growth.

Collecting information on the nutritional condition of deer helps us understand how much energy and nutrients deer are taking in versus how much they are using up. One way to assess the nutritional condition of a deer is to look at its' fat reserves. Deer condition is influenced by habitat quality, competition for food (deer density), and weather. The higher the habitat quality, the greater the quantity and quality of food, the better condition the deer are in. Fewer deer means less competition for food and thus, deer in better condition. Deep snow and ice make it more difficult to get food and move around, thus deer tend to be in worse shape following a harsh or long winter. Deer condition informs us on how easy or difficult a time deer have been experiencing.

Nutritional condition of deer influences both survival and reproduction, so it is directly related to population growth. Winter/spring survival of deer, especially those experiencing their 1st winter, is highly dependent on fat reserves. Recent research has shown that deer in Wisconsin can exhaust their fat reserves and die at this time, and the number of deer that starve is directly related to winter severity. Survival of newborn fawns is also influenced strongly by the nutritional condition of the mother, as it can determine whether a doe can produce enough milk to sustain her fawn(s). The age at which a doe first breeds, and to a lesser extent, the litter size of adult does, also depends on the nutritional condition of does at the breeding season.

Biologists have developed a number of methods to assess fat reserves in deer. WDNR biologists recently completed a statewide assessment of fat reserves, pregnancy, and litter size. This is the 1st survey of pregnancy rate since the early 1980's and the 1st springtime assessment of deer condition.

Collection and analysis methods:
During April and May, wildlife biologists opportunistically conducted assessments of nutritional condition, pregnancy rates, and litter size of car-killed white-tailed deer (CKD). Nutritional condition assessments consisted of presence/absence of fat at the rump and brisket (also called xyphoid process), classification of fat reserves at the heart, kidney, and femur marrow (see instructions in Appendix 1). The measures used have been shown to provide good information on fat reserves of deer, especially when all measures are considered together. Deer were classified as < or > 1 year of age. Biologists also recorded the location, including Deer Management Zone of each CKD. Wildlife biologists conducted 521 condition assessments, from 3/04/2014 to 5/07/2014. The median assessment date was 4/09/2014. Biologists conducted complete or partial assessments on 241 adult females, 111 juvenile females, 1 female of unknown age, 88 adult males, 79 juvenile males, and 1 male of unknown age. Biologists checked pregnancy on 323 does.

Using the metric:
We grouped the data by age class, sex, and Deer Management Zone, which allows us to see which deer were (on average) in better shape than others, and in which Management Zones reproduction is highest and which is lowest.

Over 90% of adult does were pregnant, regardless of deer management zone, while pregnancy of juvenile does was substantially lower and appeared to vary by zone. The majority of adult does in the farmland management zones had twins.

Adult deer were consistently more likely to have retained rump fat into early spring than were juvenile deer. Adult females were more likely to have rump fat than adult males. There were strong regional differences in % rump fat present, especially among adult females. The regional patterns in the percentage of deer with brisket fat present were similar to rump fat percentage patterns. The majority of adult female deer had 'moderate amounts of fat' on the heart, while most juvenile females and males had 'slight quantities of fat' or 'no fat visible'. The majority of adult males had 'moderate' or 'slight' heart fat, depending on region. There were regional differences in the distribution of heart fat ratings, with farmland deer having more fat than forest deer. Like other fat indices, kidney fat distributions differed regionally, and adults had a higher average rating than juveniles. On average, kidney fat ratings were lower than heart fat ratings.

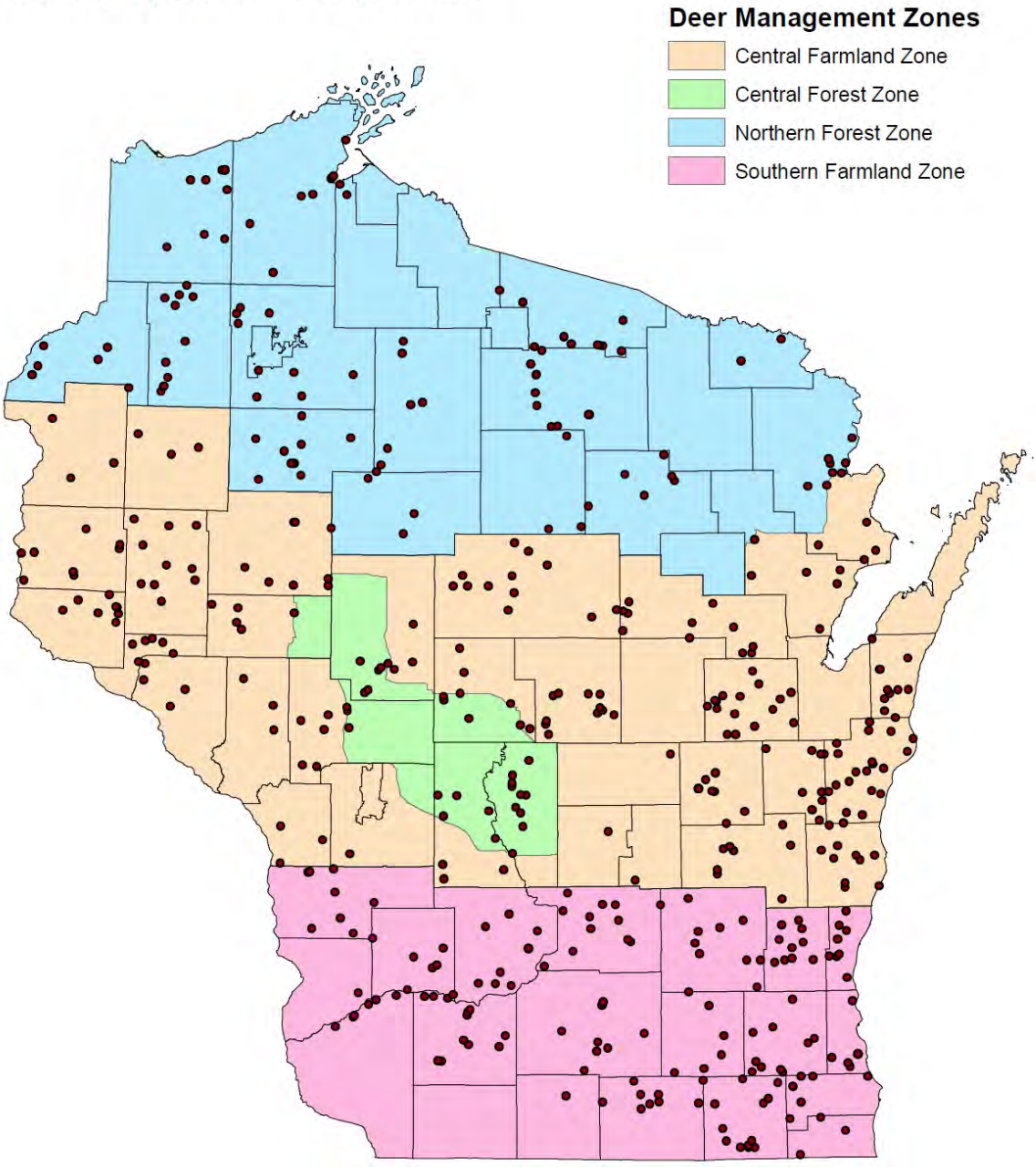
Limitations and precautions:
While our statewide sample size was very good, the sample size was not adequate to make any statements at the county level. Samples sizes are generally adequate to make statements at the Deer Management Zone level, however sample sizes in the Central Forest Management Zone are small, perhaps due to the size of the zone and the relatively lower deer populations found there.

While this data enables us to learn about how deer condition and reproduction vary place-to-place, we cannot yet say how they vary year-to-year. Collecting this data long-term would enable this sort of learning, but could take a number of years before we get a firm understanding of how condition and reproduction change through time.

Although it is clear that these metrics tell us about deer condition, it's less clear how these measures relate to deer survival and reproduction. Although, we know fatter deer are more likely to survive and produce healthy offspring), the critical tipping points remain unknown. "At what point would we say that fat reserves are too low for a doe to provide adequate milk to her offspring?" "What do the fat indices tell us about the overwinter mortality rate of deer?" Questions like these are important to interpret what the indices are telling us. Additionally, it can be difficult to tease apart the relative contributions of deer density, weather, and habitat quality to deer condition and reproduction.

Future needs:
Further analysis of the recently collected data will help shed light on some of the factors that explain geographic variation in deer condition and reproduction. Additionally, it will be important to develop a research plan which will help us interpret deer condition indices.

Location of car-killed deer nutritional assessments conducted during March, April, and May, 2014



Wildlife biologists conducted 521 condition assessments, from 3/04/2014 to 5/07/2014. The median assessment date was 4/09/2014. Biologists conducted complete or partial assessments on 241 adult females, 111 juvenile females, 1 female of unknown age, 88 adult males, 79 juvenile males, and 1 male of unknown age. Biologists checked pregnancy on 323 does.

Table 1. Pregnancy rates of juvenile and adult white-tailed deer, by Deer Management Zone. Data come from assessments of car-killed deer conducted during March, April, and May 2014.

	Age Class	Number Not Pregnant	Number Pregnant	% pregnant
Central Farmland	<1	43	11	0.20
	>1	8	95	0.92
Central Forest	<1	4	-	0.00
	>1	-	13	1.00
Northern Forest	<1	10	1	0.09
	>1	4	51	0.93
Southern Farmland	<1	23	2	0.08
	>1	5	53	0.91

Table 2. Litter size distributions and mean litter size of juvenile and adult white-tailed deer, by Deer Management Zone. Data come from assessments of car-killed deer conducted during March, April, and May 2014.

	Age Class	Litter Size				Mean Litter Size	N
		0	1	2	3		
Central Farmland	<1	0.80	0.19	0.02	0.00	0.22	54
	>1	0.08	0.17	0.69	0.06	1.73	103
Central Forest	<1	1.00	0.00	0.00	0.00	0.00	4
	>1	0.00	0.08	0.92	0.00	1.92	13
Northern Forest	<1	0.91	0.09	0.00	0.00	0.09	11
	>1	0.07	0.44	0.45	0.04	1.45	55
Southern Farmland	<1	0.92	0.08	0.00	0.00	0.08	25
	>1	0.09	0.22	0.62	0.07	1.67	58

Table 3. The percentage (by age class and Deer Management Zone) of female deer in which rump fat was present during the March-early May 2014 sampling period.

		Rump fat present?		
	Age Class	NO	YES	% present
Central Farmland	<1	50	6	10.7
	>1	66	33	33.3
Central Forest	<1	4	0	0.0
	>1	10	3	23.1
Northern Forest	<1	15	1	6.3
	>1	50	10	16.7
Southern Farmland	<1	21	6	22.2
	>1	30	30	50.0

Table 4. The percentage (by age class and Deer Management Zone) of male deer in which rump fat was present during the March-early May 2014 sampling period.

		Rump fat present?		
	Age Class	NO	YES	% present
Central Farmland	<1	21	3	12.5
	>1	27	7	20.6
Central Forest	<1	4	-	0.0
	>1	4	1	20.0
Northern Forest	<1	17	-	0.0
	>1	15	1	6.3
Southern Farmland	<1	31	1	3.1
	>1	25	7	21.9

Table 5. The percentage (by age class and Deer Management Zone) of female deer in which fat was present at the xyphoid process (brisket) during the March-early May 2014 sampling period.

		Xyphoid fat present?		
	Age Class	NO	YES	% present
Central Farmland	<1	50	6	10.7
	>1	61	37	37.8
Central Forest	<1	4	0	0.0
	>1	10	3	23.1
Northern Forest	<1	15	1	6.3
	>1	48	13	21.3
Southern Farmland	<1	23	6	20.7
	>1	27	35	56.5

Table 6. The percentage (by age class and Deer Management Zone) of male deer in which was present at the xyphoid process (brisket) during the March-early May 2014 sampling period.

		Xyphoid fat present?		
	Age Class	NO	YES	% present
Central Farmland	<1	21	3	12.5
	>1	21	13	38.2
Central Forest	<1	3	1	25.0
	>1	4	1	20.0
Northern Forest	<1	17	-	0.0
	>1	15	1	6.3
Southern Farmland	<1	28	4	12.5
	>1	14	14	50.0

Table 7. Distribution of heart fat ratings, by Deer Management Zone and age class for female deer, examined for pregnancy and nutritional condition by wildlife biologists, during March-early May 2014 in Wisconsin.

		Heart Fat			
	Age Class	Heavy quanties of fat	Moderate amounts of fat	Slight quanties of fat	No visible fat
Central Farmland	<1	0.04	0.32	0.43	0.21
	>1	0.05	0.57	0.31	0.07
Central Forest	<1	0.00	0.00	0.25	0.75
	>1	0.00	0.69	0.23	0.08
Northern Forest	<1	0.00	0.20	0.40	0.40
	>1	0.00	0.45	0.33	0.22
Southern Farmland	<1	0.08	0.42	0.42	0.08
	>1	0.10	0.64	0.18	0.08

Table 8. Distribution of heart fat ratings, by Deer Management Zone and age class for male deer, examined for nutritional condition by wildlife biologists, during March-early May 2014 in Wisconsin.

		Heart Fat			
	Age Class	Heavy quanties of fat	Moderate amounts of fat	Slight quanties of fat	No visible fat
Central Farmland	<1	0.09	0.18	0.50	0.23
	>1	0.09	0.27	0.61	0.03
Central Forest	<1	0.00	0.00	0.50	0.50
	>1	0.00	0.80	0.00	0.20
Northern Forest	<1	0.00	0.13	0.47	0.40
	>1	0.00	0.25	0.44	0.31
Southern Farmland	<1	0.00	0.47	0.47	0.06
	>1	0.10	0.48	0.35	0.06

Table 9. Distribution of kidney fat ratings, by Deer Management Zone and age class for female deer, examined for pregnancy and nutritional condition by wildlife biologists, during March-early May 2014 in Wisconsin.

		Kidney Fat			
	Age Class	Heavy quanties of fat	Moderate amounts of fat	Slight quanties of fat	No visible fat
Central Farmland	<1	0.04	0.18	0.53	0.26
	>1	0.18	0.33	0.38	0.12
Central Forest	<1	0.00	0.00	0.25	0.75
	>1	0.08	0.31	0.54	0.08
Northern Forest	<1	0.00	0.08	0.31	0.62
	>1	0.05	0.25	0.38	0.32
Southern Farmland	<1	0.00	0.17	0.78	0.04
	>1	0.39	0.28	0.28	0.05

Table 10. Distribution of kidney fat ratings, by Deer Management Zone and age class for male deer, examined for nutritional condition by wildlife biologists, during March-early May 2014 in Wisconsin.

		Kidney Fat			
	Age Class	Heavy quanties of fat	Moderate amounts of fat	Slight quanties of fat	No visible fat
Central Farmland	<1	0.05	0.05	0.41	0.50
	>1	0.06	0.25	0.66	0.03
Central Forest	<1	0.00	0.00	0.50	0.50
	>1	0.00	0.00	0.80	0.20
Northern Forest	<1	0.00	0.07	0.47	0.47
	>1	0.00	0.06	0.56	0.38
Southern Farmland	<1	0.03	0.23	0.55	0.19
	>1	0.07	0.29	0.57	0.07

Table 11. Distribution of femur marrow fat ratings, by Deer Management Zone and age class for female deer, examined for pregnancy and nutritional condition by wildlife biologists, during March-early May 2014 in Wisconsin.

		Marrow Fat		
	Age Class	Full fat	Intermediate fat	Red Jelly
Central Farmland	<1	0.28	0.56	0.16
	>1	0.49	0.43	0.09
Central Forest	<1	0.00	0.00	1.00
	>1	0.62	0.31	0.08
Northern Forest	<1	0.06	0.41	0.53
	>1	0.33	0.38	0.30
Southern Farmland	<1	0.43	0.53	0.03
	>1	0.68	0.26	0.06

Table 12. Distribution of femur marrow fat ratings, by Deer Management Zone and age class for male deer, examined for nutritional condition by wildlife biologists, during March-early May 2014 in Wisconsin.

		Marrow Fat		
	Age Class	Full fat	Intermediate fat	Red Jelly
Central Farmland	<1	0.20	0.40	0.40
	>1	0.56	0.38	0.06
Central Forest	<1	0.00	0.25	0.75
	>1	0.40	0.40	0.20
Northern Forest	<1	0.24	0.35	0.41
	>1	0.25	0.50	0.25
Southern Farmland	<1	0.16	0.68	0.16
	>1	0.45	0.52	0.03

Metric Type: CWD Prevalence

Background: Chronic Wasting Disease (CWD) is a fatal, contagious neurological disease known to infect white-tailed deer, mule deer, elk, and moose. It causes a characteristic spongy degeneration of the brains of infected animals resulting in emaciation, abnormal behavior, loss of bodily functions and death. CWD belongs to a group of diseases known as transmissible spongiform encephalopathies (TSEs). Other TSEs include scrapie in sheep, bovine spongiform encephalopathy (BSE, also called "mad cow disease") in cattle, transmissible mink encephalopathy in farmed mink, and Creutzfeld-Jakob disease in humans. CWD has the potential for significant, negative impacts on the future of deer and deer hunting wherever it exists.

CWD was first detected in Wisconsin in 2002 when three deer taken by hunters near the village of Mount Horeb, about 10 miles southwest of Madison, tested positive. Since that time an intensive surveillance effort has been undertaken to better understand the geographic distribution of the disease, the prevalence of the disease where it occurs, and changes in the prevalence over time. Through July 2014, 185,246 deer have been tested in Wisconsin and 2,515 have tested positive for CWD. Currently, CWD has been detected in 18 of Wisconsin's 72 counties.

Collection and analysis methods: Mandatory registration has allowed wildlife biologists to take biological samples for CWD testing at registration stations around the state. Age, sex, and kill location (deer management unit, county, and Public Land Survey System [PLSS] township/section) were collected for harvested deer. Retro-pharyngeal lymph nodes were collected for CWD diagnosis by the Wisconsin Veterinary Diagnostic Laboratory.

The WDNR conducted statewide disease detection surveillance efforts in 2002-2003, and again in 2005-2008, and have transitioned to annual weighted detection surveillance since the 2011 deer season. Permanent monitoring areas were established around the centers of disease foci in southwestern (SW Core Area) and southeastern (SE Monitoring Area) Wisconsin where annual efforts were made to test the majority of harvested deer > 1.5 years old. Less intensive monitoring was conducted elsewhere in southern Wisconsin in the area formerly known as the CWD Management Zone.

Prevalence is the proportion or percentage of a population that tests positive for a disease. CWD prevalence is influenced by the sex and age of the deer and geographic location. CWD prevalence tends to be higher in males than in females and higher in adults than yearlings. Because prevalence varies by sex, age, and location it is important to control for these variables when analyzing changes in prevalence over time. Therefore, analyses of CWD prevalence change were made for selected study areas using statistical models that incorporated information on sex and age of the animal tested. The areas analyzed were selected based on the geographic distribution of disease and the number of deer that have been tested.

The geographic distribution of CWD prevalence has been represented by a map of prevalence by PLSS township during 2010-13. For this map, results from all yearling and adult males and females tested during 2010-13 were combined and prevalence was estimated if 30 or more deer were tested in the township.

Using the metric: Data are provided that shows the number of deer tested and the number positive for CWD during 2002-2013 for each county in Wisconsin.

The CWD prevalence map shows the geographic distribution of disease. There are two central areas of CWD infection in Wisconsin. One is centered in western Dane and eastern Iowa counties. The other is located in northern Illinois and extends into southeastern Wisconsin. Analyses of the geographic distribution of disease show that the disease is not evenly distributed throughout the affected area. Disease

prevalence is much higher near the centers of each infection and declines with increasing distance from the center as would be expected with an introduced disease.

In all of the study areas analyzed, CWD prevalence has increased since 2002. In the western core monitoring area during the past 12 years, prevalence has more than doubled, increasing in adult males from 8-10 percent to nearly 25 percent, and in adult females from about 3-4 percent to more than 10 percent. During that same time, the prevalence yearling males has increased from about 2 percent to about 7 percent and in yearling females from roughly 2 percent to about 6 percent.

Similar increases in prevalence have occurred in the other study areas. Just west of the western core in north-central Iowa County, adult male prevalence has increased more than 7 fold from less than 5% to about 35%. Prevalence in the southeast monitoring area as approximately doubled since 2003. Study areas north of the Wisconsin River in southern Richland and Sauk counties have seen prevalence in adult males increase from near 0 in 2002 to approximately 15% in 2013. Adult male prevalence in the furthest north study area, near Baraboo and Devil's Lake, has increased from near 0 to over 2% during the past 12 years.

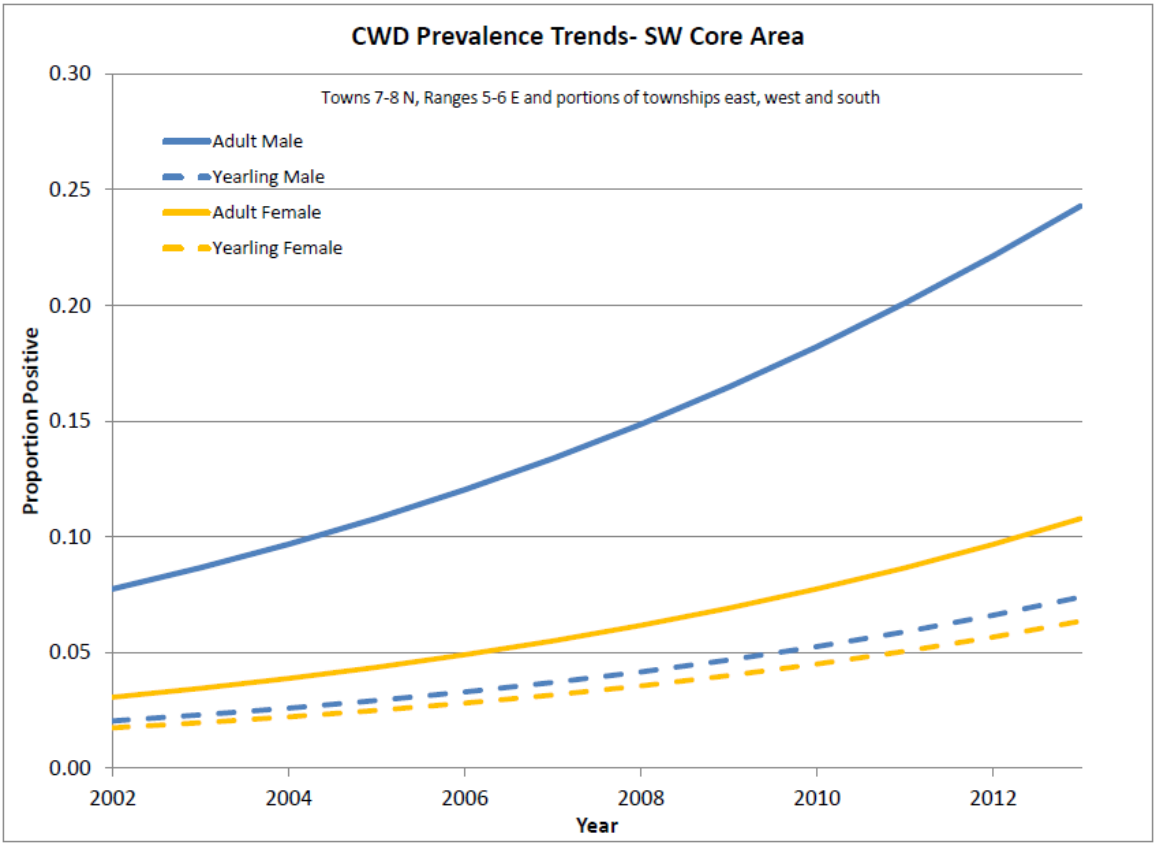
Limitations and precautions: Limited funding precludes sampling everywhere every year. Because sample sizes are limited estimation of the geographic distribution of disease requires pooling data over multiple years. Likewise, estimation of changes in time require combining data over multiple areas (e.g., townships).

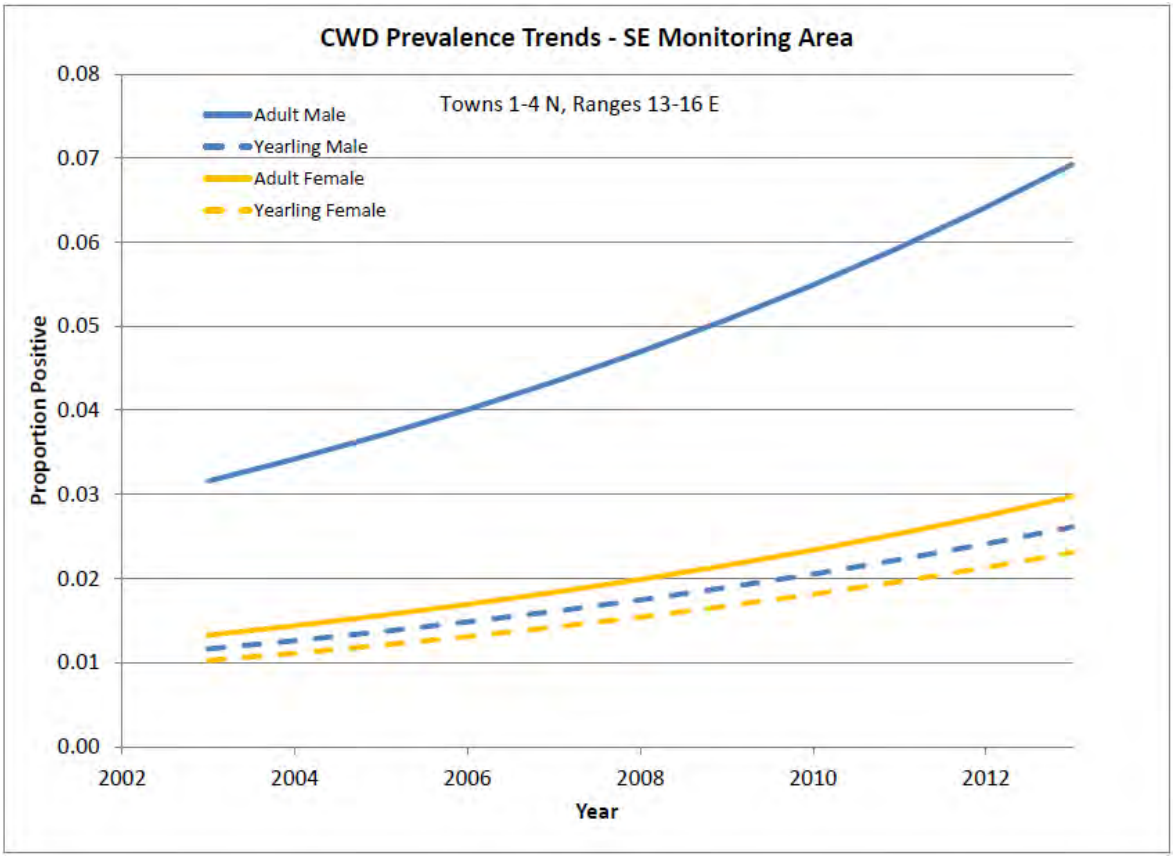
Due to funding and sampling limitations, CWD testing priorities have been focused in the core monitoring areas and southern CWD affected counties, previously referred to as the management zone. In 2012, a pilot study was initiated to inform prioritization efforts on a statewide scale, using a weighted sampling scheme that utilizes samples collected from taxidermists. The department also continues actively surveying across the state by utilizing sick deer reports.

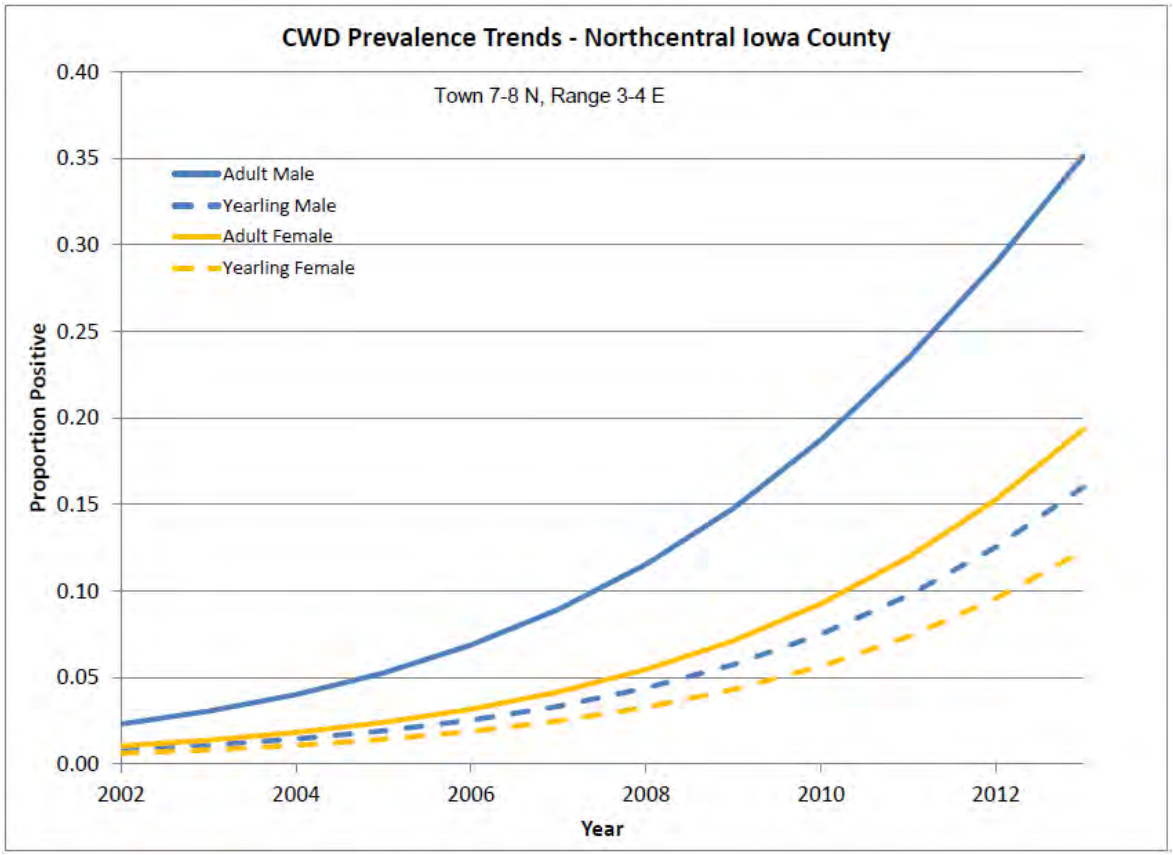
Future needs: It will be important to develop ways to cost-effectively assess CWD prevalence once eRegistration is fully implemented.

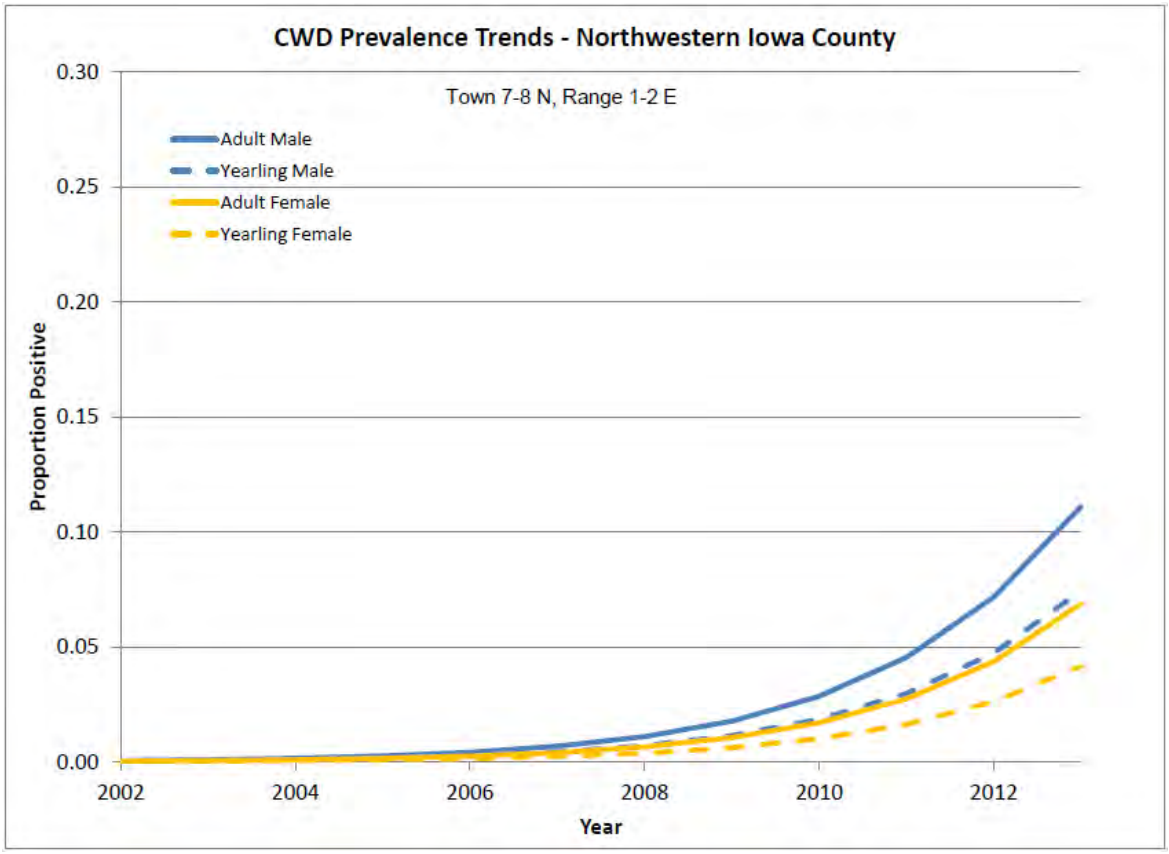
Summary of CWD testing in Walworth County

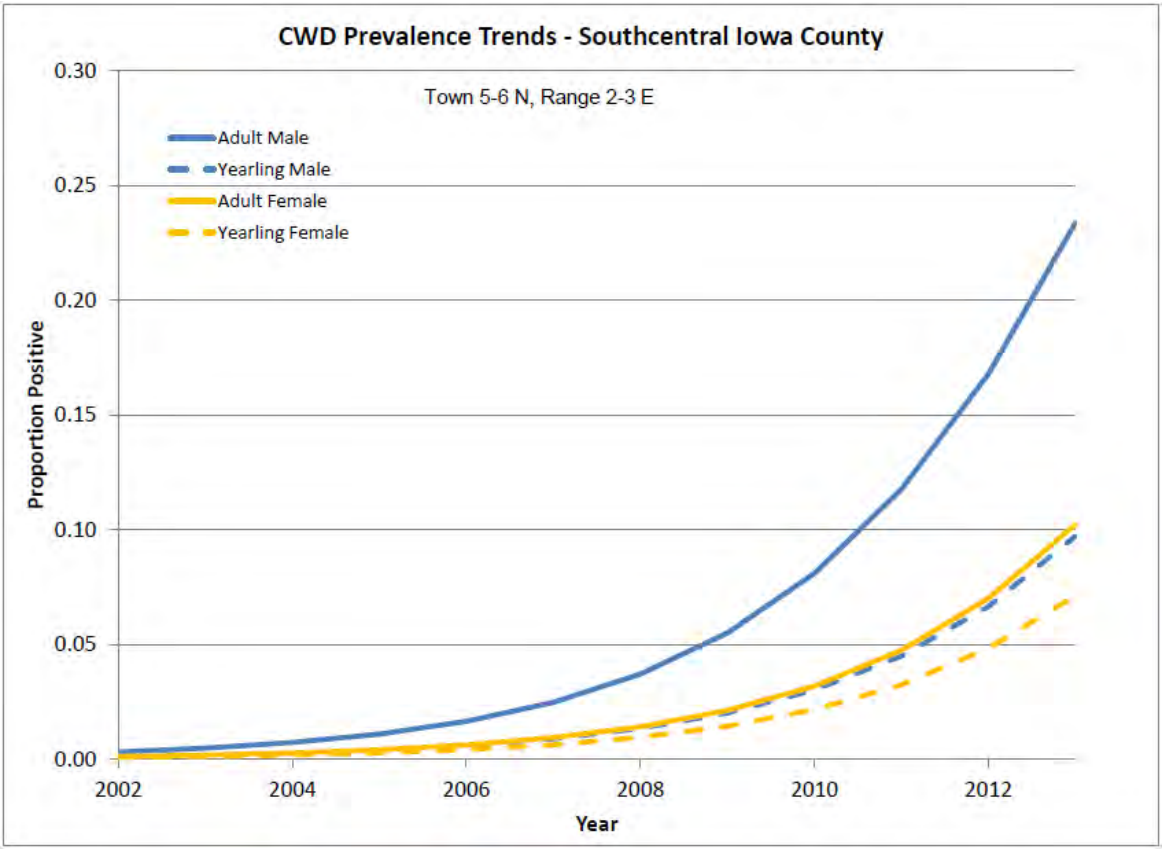
County		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Walworth	N tested	125	312	1514	1233	1268	604	338	268	291	244	273	140
	N positive	0	2	9	7	21	8	7	4	3	1	6	3

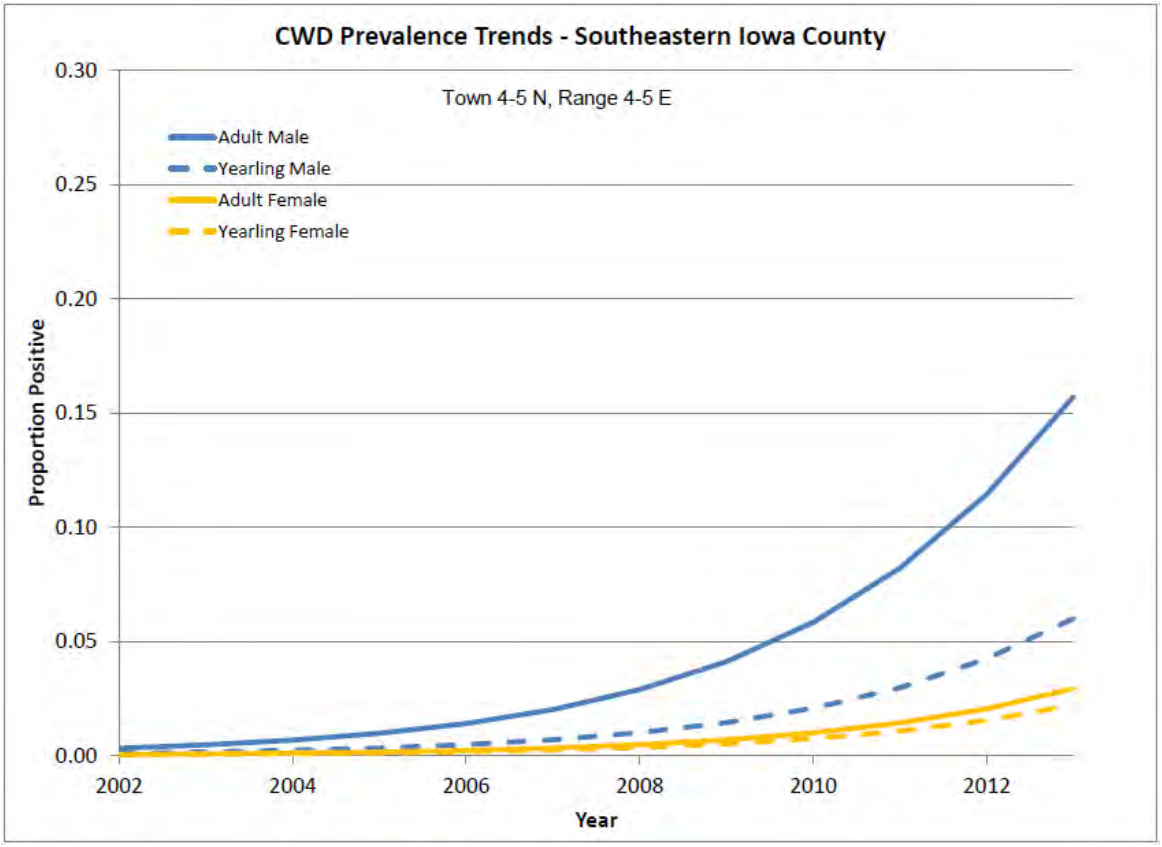

CWD Prevalence Trends- SW Core Area
Towns 7-8 N, Ranges 5-6 E and portions of townships east, west and south
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year

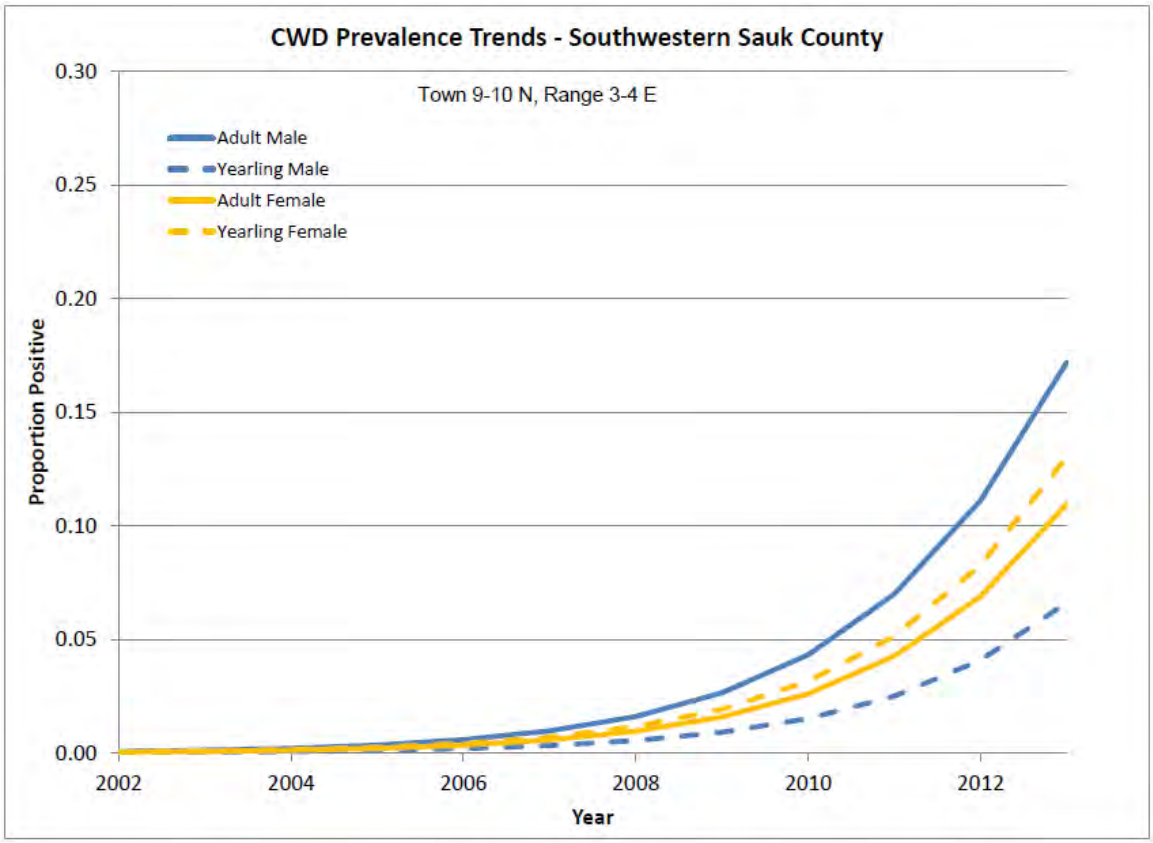

CWD Prevalence Trends - SE Monitoring Area
Towns 1-4 N, Ranges 13-16 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
2002
2004
2006
2008
2010
2012
Year

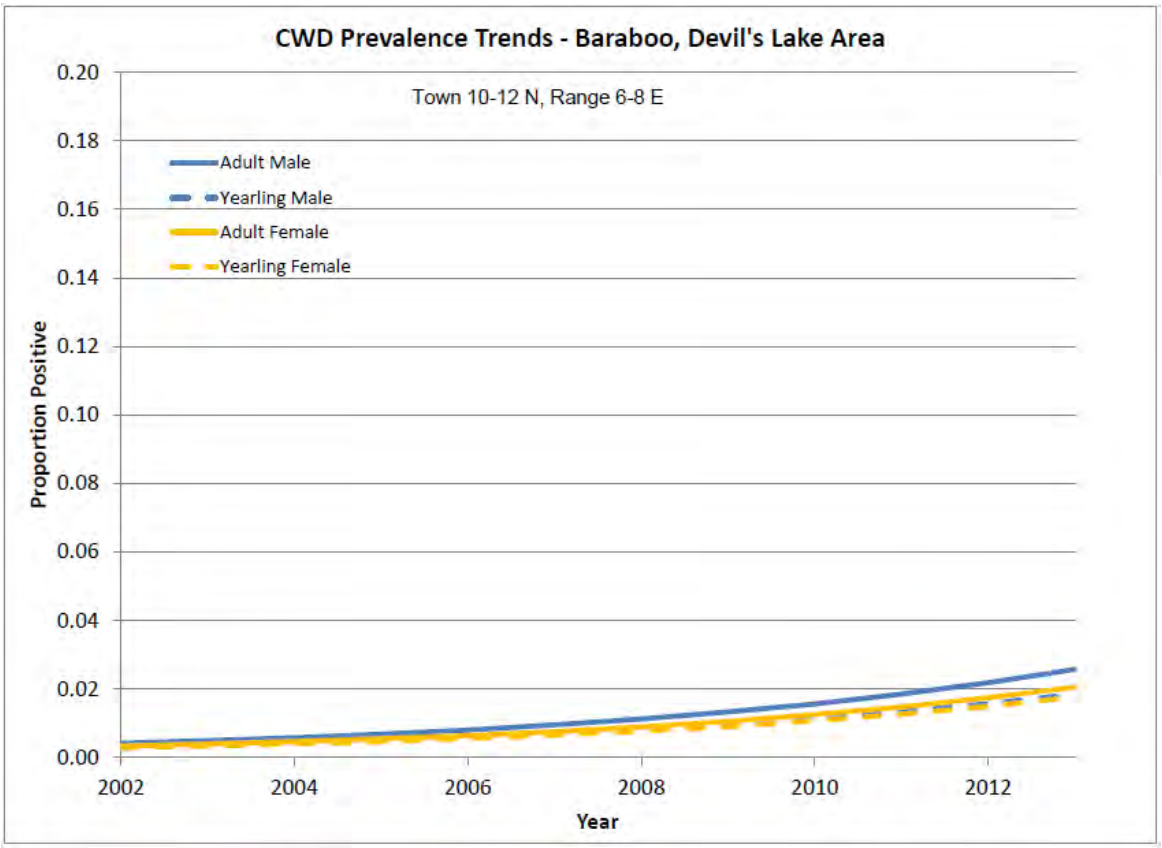

CWD Prevalence Trends - Northcentral Iowa County
Town 7-8 N, Range 3-4 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year

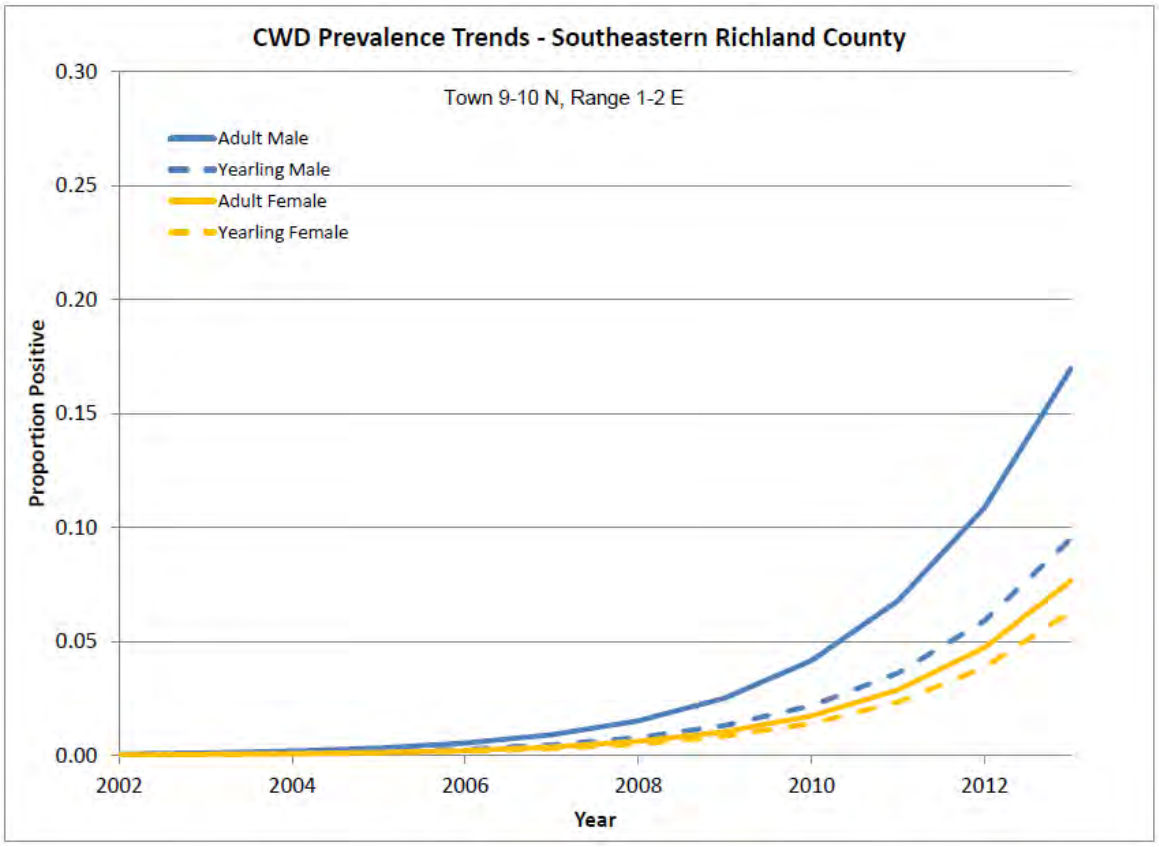

CWD Prevalence Trends - Northwestern Iowa County
Town 7-8 N, Range 1-2 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year

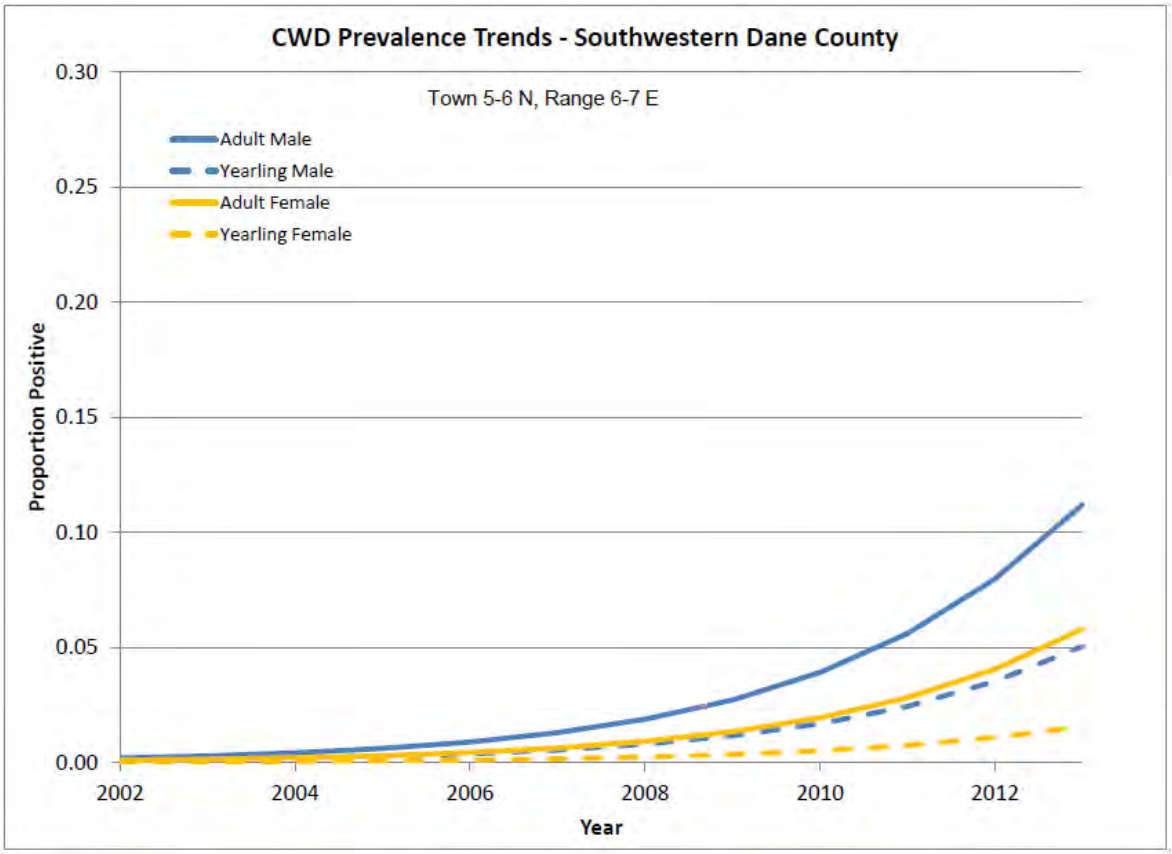

CWD Prevalence Trends - Southcentral Iowa County
Town 5-6 N, Range 2-3 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year


CWD Prevalence Trends - Southeastern Iowa County
Town 4-5 N, Range 4-5 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year


CWD Prevalence Trends - Southwestern Sauk County
Town 9-10 N, Range 3-4 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year


CWD Prevalence Trends - Baraboo, Devil's Lake Area
Town 10-12 N, Range 6-8 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
2002
2004
2006
2008
2010
2012
Year


CWD Prevalence Trends - Southeastern Richland County
Town 9-10 N, Range 1-2 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year


CWD Prevalence Trends - Southwestern Dane County
Town 5-6 N, Range 6-7 E
Adult Male
Yearling Male
Adult Female
Yearling Female
Proportion Positive
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2002
2004
2006
2008
2010
2012
Year

Informational on Hemorrhagic disease (HD)

Background:

Hemorrhagic disease (HD) is an acute, infectious, often fatal, viral disease that affects white-tailed deer as well as other hoofed animals. In areas where HD regularly occurs, death rates are lower, usually less than 25 percent of the population. In areas where the disease rarely occurs, like here in Wisconsin, death rates can be much higher. High-density deer herds may have higher mortality rates. The disease is caused by either bluetongue virus or the epizootic hemorrhagic disease virus (EHDV); however, the visible signs of the disease are virtually indistinguishable with both the viruses. The disease is transmitted by biting flies often referred to as no-see-ums *(Culicoides* midges). The virus does not survive long outside the insect or the deer host.

Deer can display multiple symptoms depending on how long they are infected. Deer that are infected and have the most severe cases of the disease may be unafraid of humans, salivate excessively, have foam present around the nose (sometimes with blood), appear weak but in good body condition and may appear to have swollen areas of their body (typically areas of the head and neck). Deer may also be found in or near water as they can develop very high fevers and be dehydrated. In some instances of the more chronic form of the disease, deer may have erosions or ulcerations in their mouth, be very thin, and have detachment of the wall of their hoof making it very hard for them to walk. In deer that recover, abnormal hoof growth may be noted.

Outbreaks of EHD, tend to be localized in nature and not have wide scale impacts on state herds and there is currently no management technique available to combat EHDV in the field.

The viruses that cause hemorrhagic disease do not infect humans. Therefore, humans are not at risk when handling infected deer, eating venison from infected deer or being bitten by infected *Culicoides* midges (no-see-ums).

HD in Wisconsin

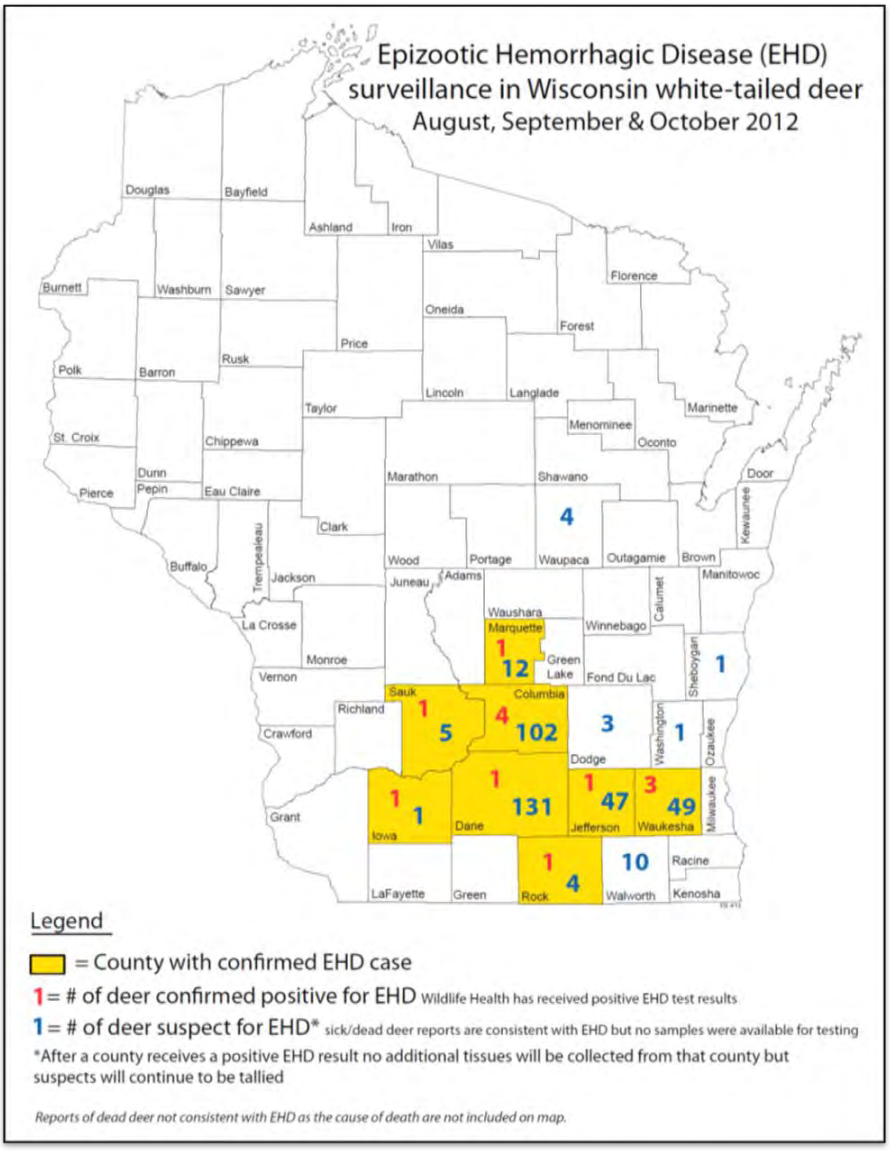
The disease was diagnosed for the first time in Wisconsin deer in 2002, when approximately 14 deer were found suddenly dead in Iowa County during September. Between 2002 and 2011, deer surveyed and tested did not show antibodies in their blood to either of the viruses that cause HD, indicating that it does not occur commonly in Wisconsin (antibodies are a measure of an animal's exposure to a pathogen. An animal does not have to develop clinical disease for antibodies to be present in their blood, they just have to be exposed).

In the late summer, early fall of 2012, many states in the Midwest began to see dead deer on the landscape. Epizootic hemorrhagic disease (multiple strains) was isolated from a number of these carcasses. Deer found dead from eight southern Wisconsin counties (Columbia, Rock, Dane, Sauk, Iowa, Marquette, Jefferson and Waukesha) tested positive for Epizootic Hemorrhagic Disease (EHD).

While there is no known management technique currently available to combat EHDV in the field, it is important that we gain as much information as we can during an outbreak including the serotype of the virus involved. There are three epizootic hemorrhagic disease virus (EHDV) serotypes - EHDV 1, 2, and 6 that have been serotyped in the US as well as a reassortment referred to as EHDV-6 (Indiana). 6 is actually a new serotype to the continent and as such, outbreaks have occurred in areas where EHDV 1 and 2 are endemic (primarily the southern US) and it is considered an emerging pathogen in cattle in Northern Africa and Europe. Also, EHDV-6(Indiana) was the serotype of the virus that was present in Indiana and Illinois in 2006 as well as this year. From a management perspective, documenting the serotypes that

contribute to an outbreak help to evaluate the short and long term costs to the deer population through loss and also possibly through the presence or absence of acquired immunity. As exposure to one of the serotypes does not provide immunity to another, should we have further outbreaks, it is vital that we are able to determine if it they are being caused by another serotype or if our herd continues to be susceptible to the same serotype. Also, Culicoides sp. efficiency in maintaining and transmitting the virus might vary by serotype. If Wisconsin midges are poorly adapted to EHDV 1 & 2, it is possible they could be more adapted to EHDV 6 and this could add more complexity to outbreak occurrences. Documenting the serotypes helps to establish the necessary questions for further disease investigations into any possible long-term impacts on deer herds.
As such samples from dead deer during the 2012 outbreak were also submitted to SCWDS for serotyping. The only serotype isolated from Wisconsin for 2012 was EHDV-6 (epizootic hemorrhagic disease virus, serotype 6). However, it is important to remember not all deer found were tested. In total, 427 deer were confirmed positive or suspected to have died from EHD (Figure 1) in 8 counties.

We are not yet sure what this will mean in regards to EHDV in Wisconsin and we will continue to be on the alert for outbreaks in the future. In order to sample for EHD, carcasses must be fresh.



Agricultural Deer Metrics

Metric Type: Deer Damage to Agriculture Crops

Background: According to the USDA -National Agriculture Statistics Service's 2012 census Wisconsin ranks 9th in the nation for the total value of agricultural crops sold. This statistic reinforces the importance of agriculture to Wisconsin's economy. In areas of high deer abundance negative impacts from deer browsing can have a significant economic impact on agriculture producers. It is important to consider these negative impacts when recommending decreasing, stabilizing, or increasing deer populations in each county.

Collection and analysis methods:
The Wildlife Damage Abatement and Claims Program (WDACP) provides damage abatement assistance and partial compensation to agriculture producers experiencing damage to agriculture crops from deer. Currently 70 Wisconsin counties participate in the program, Menominee and Kenosha counties are the only counties that do not participate. The WDACP is a voluntary program allowing individual producers to determine what level of deer damage is tolerable to them before deciding to enroll in the program. Through this program information including the number of producers enrolled in the program for deer damage, the number of deer shooting permits issued and deer harvested, and appraised deer damages will be available to each County Deer Advisory Committee when making recommendations to change or maintain deer populations within the county.

Using the metric:
Agriculture damage and deer shooting permit information can be used as an index to track impacts deer are having on agriculture producers within a county. This data would be useful in determining 3 year population objectives to increase, stabilize, or decrease deer populations within the county and for developing annual antlerless deer quota recommendations.

Limitations and precautions:
The WDACP is a voluntary program and does not reflect the total amount of agriculture damage that is being done by deer within a county. Individual tolerances to deer damage vary and there are a variety of other social factors that impact a producer's choice to enroll in the program. For example, there are very few WDACP enrollments in Buffalo County because of the program's public hunting access requirement even though some producers are experiencing significant damages from deer. To these producers not having to allow public hunting access is more important than receiving compensation for the deer damages.
By Wisconsin Administrative Code participating counties do not need to submit wildlife damage claims to the department until March 1 following the calendar year in which damage occurred and the department has until June 1 to process the claim. Because of these deadline there will be a 1-year lag in appraised deer damage information being available to the CDAC's, i.e. 2014 appraised deer damages will not be available to the CDAC's until June of 2015.

Future needs:
Because the WDACP is a voluntary program there is a need to conduct social surveys to better gauge the level of deer damage that is occurring and what social factors influence a producer's tolerance to deer damage. there it does not provide a comprehensive analysis of the deer damage that is occurring in each county and the need to identify the social factors within the that determine whether a producer enrolls in the WDACP.

County: WALWORTH

	2009	2010	2011	2012	2013
# WDACP Deer Enrollments	5	4	6	5	7
# of Deer Shooting Permits Issued	2	3	3	3	6
# of Deer Harvested on Shooting Permits	7	10	9	4	4
Number of Claims Submitted for Deer Dmg	0	0	0	0	0
Total Apraised Deer Damage	$0.00	$0.00	$0.00	$0.00	$0.00
Total Acres Appraised	0	0	0.0	0	0
Total Acres Damaged by Deer	0	0	0.0	0	0
Ratio Appraised Ac:Damaged Ac	0	0	0.0	0	0
Appraised Damage (Corn)	$0.00	$0.00	$0.00	$0.00	$0.00
Appraised Acres (Corn)	0	0	0	0	0
Damaged Acres (Corn)	0	0	0	0	0
Ratio Appraised Ac:Damaged Ac	0	0	0	0	0
Yield Loss (Corn, bushels)	0	0	0	0	0
Appraised Damage (Soybeans)	$0.00	$0.00	$0.00	$0.00	$0.00
Appraised Acres (Soybeans)	0	0	0	0	0
Damaged Acres (Soybeans)	0	0	0	0	0
Ratio Appraised Ac:Damaged Ac	0	0	0	0	0
Yield Loss (Soybeans, bushels)	0	0	0	0	0
Post Hunt Population	8,752	6,814	6,789	6,977	7,092
Deer Range Sq. Miles	177	177	177	177	177
Sq miles of total land (Source: U.S. Census)	555.13	555.13	555.13	555.13	555.13
Sq miles of Agriculture Land (Source: NASS)	284.81	284.81	284.81	256.10	256.10
Total Crop land Farms (Source: NASS)	861	861	861	743	743
Total Crop land Acres (Source: NASS)	182,277	182,277	182,277	163,902	163,902

2009					
Crop	**No. of Claims**	**Assessed Damage**	**Appraised Acres**	**Damaged Acres**	**Loss on Yield**
Corn Grain	1	$0.00	0	0	0
Total		$0.00	0	0	0
2010					
Crop	**No. of Claims**	**Assessed Damage**	**Appraised Acres**	**Damaged Acres**	**Loss on Yield**
Total		$0.00	0	0	0
2011					
Crop	**No. of Claims**	**Assessed Damage**	**Appraised Acres**	**Damaged Acres**	**Loss on Yield**
Total		$0.00	0	0	0
2012					
Crop	**No. of Claims**	**Assessed Damage**	**Appraised Acres**	**Damaged Acres**	**Loss on Yield**
Total		$0.00	0	0	0
2013					
Crop	**No. of Claims**	**Assessed Damage**	**Appraised Acres**	**Damaged Acres**	**Loss on Yield**
Total		$0.00	0	0	0

Metric Type: Tolerable Levels of Agriculture Damage

Background: Through the Deer Management for 2000 and Beyond Project, the Agriculture Damage Study Group developed metrics for defining tolerable levels of deer damage to agriculture crops. Tolerable levels of deer damage are defined in WI Administrative Code NR1.15(2)(am) as follows:

Tolerable levels of deer damage to crops. Deer damage to crops in a deer management unit exceeds tolerable levels when the crop damage is greater than 2.5 times the median in 2 of the following 4 indicators:

1. Appraised deer damage losses per 100 overwinter deer.

2. Appraised deer damage losses per square mile of land in the deer management unit.

3. Appraised deer damage losses per square mile of agricultural land in the deer management unit.

4. Number of claims for deer damage per 100 square miles of total land.

Administrative code specifies that high value crops such as vegetables and nursery stock be omitted in these calculations to avoid skewing the results where significant damages may be occurring as a result of the commodity price and not necessarily because of high concentrations of deer.

Collection and analysis methods:
Information for these metrics is collected on wildlife damage claims submitted to the department through Wildlife Damage Abatement and Claims Program (WDACP). Under this program county wildlife damage technicians perform field appraisal using standardized crop appraisal methods to determine losses that resulted specifically from deer. Under program rules producers are required to notify the county wildlife damage technician at least 10 days prior to harvesting the crop so an appraisal can be conducted. The WDACP provides damage abatement assistance and partial compensation to agriculture producers experiencing damage to agriculture crops from deer. Currently 70 Wisconsin counties participate in the program, Menominee and Kenosha counties are the only counties that do not participate.

Using the metric:
Under NR 1.15 (2) (at) If crop damage in a deer management unit with an objective to maintain or increase the population is above the tolerable limit in 2 years out of a 3 year period prior to a unit review under s. NR 10.104 (3), the department shall consider establishing an objective to reduce or maintain the deer population.

Limitations and precautions:
These metrics were developed for use on a Deer Management Unit (DMU's) scale where land uses, i.e. agricultural areas, are better delineated than county management units. In addition the information collected through the WDACP currently does not differentiate between the forested and farmland zones so historical information is not available for counties that have both the forested and farmland zones. Changes will be made so this information is collected beginning in 2015.

Walworth County land attributes and appraised deer damage losses determined through the wildlife damage program, 2011–2013.

County land attributes	Square miles	Acres
Total land	555.13	355,283.20
Crop land	256.10	163,902.00

	Year		
Deer metrics	2011	2012	2013
Overwinter deer population	6,789	6,977	7,092
WDACP appraised deer damage	$0.00	$0.00	$0.00
Number of claims	0	0	0
Deer damage losses criteria			
1) Appraised per 100 overwinter deer	$0.00	$0.00	$0.00
2) Appraised per mi^2 of total land	$0.00	$0.00	$0.00
3) Appraised per mi^2 of crop land	$0.00	$0.00	$0.00
4) Number of claims per 100 mi^2 of total land	0.00	0.00	0.00
Intolerable level of deer damage met/exceeded?	No	No	No
Appraised damages, non-high value crops			
Alfalfa	$0.00	$0.00	$0.00
Alfalfa/grass	$0.00	$0.00	$0.00
Corn grain	$0.00	$0.00	$0.00
Corn silage	$0.00	$0.00	$0.00
Grass	$0.00	$0.00	$0.00
Hay	$0.00	$0.00	$0.00
Haylage	$0.00	$0.00	$0.00
Small grains	$0.00	$0.00	$0.00
Soybeans	$0.00	$0.00	$0.00

Forest Health Metrics

Metric Type: Forest Regeneration Data

Background

While not always realized, light to moderate deer browsing can increase forest biodiversity and provide positive benefits to forest health. However, if browsing is greater than what a forest can withstand, not only can the future forest regeneration become compromised, but available browse for future generations of deer can become depleted and can decrease the overall deer carrying-capacity of the forest. It is important to have an abundance of tree seedlings (< 2"), saplings (2 - 5") and pole-size trees (5 – 11") across the region. These size classes are important for regenerating forests and are also important size classes available to deer and other wildlife as browse.

To understand if the forest regeneration is becoming compromised, foresters will use the abundance of stems per acre, or in other words "stem density." Stem density becomes even more valuable when analyzed by size class. When data are available it is important to track the stem density of early-aged trees through time. These types of data provided valuable context for what has happened in the past and provides an understanding of what stem density is possible. The data provided in this report focuses specifically on important tree species for deer. While some may debate on the cause of changes in stem density or "availability" of these species, at the end of the day it is the availability that dictates the deer carrying capacity of our forests and furthermore, the ability of our forests to sustain forest products and habitat for all other wildlife species.

Collection and analysis methods

The forest regeneration data presented in this report come from the U.S. Forest Service's Forest Inventory Analysis (FIA). Fixed plots are spaced approximately every 2,000 acres across the U.S. on both public and private land. It is important to note that some of these plots fall on non-forested lands. For the purposes of this analysis, we only utilized forested FIA plots. Each plot is inventoried every five years, to provide valuable insight into how our forests are changing through time. We selected the years 1983, 1996, 2004, 2009 and 2013 to illustrate the change in our forests over time. We have further divided the data into the nine groups that span the state of Wisconsin. Providing data at a county level is not appropriate when only utilizing FIA as the sample size is too small.

The FIA dataset was used to provide density data for important tree species across Wisconsin that are highly palatable to deer and have the potential to be over browsed. Furthermore, we only focus on size classes between 1" and 9". We do not provide data on tree seedlings between 0.01"-1" because FIA did not collect these data during the 1983 and 1996 data collection periods. Size classes above 9" were not considered vulnerable to deer because of their height, nor do these size classes typically provide an abundance of deer browse. The tree species density is calculated using the entire forested area of a single deer management group. It is important to note that while some of these densities appear to be low, it is because the calculation is based on entire forested group area and we are only selecting certain species and certain size classes that are of importance to deer.

Using the metric

These data illustrate the direction of our future forests across each of Wisconsin's nine deer management groups. The stem density by species provides an overview of what is available in each region. In this report we provide data dating back to 1983 as well as multiple intervals until the latest 2013 data. Those reading this document should use these figures to understand how forest species are changing through time for a respective deer management group. While changes in climate (e.g. long-term drought), and forest management can play significant factors in altering the abundance of certain species, we have tried to specifically select tree species that are highly susceptible to deer browse. Numerous deer browse studies have shown that Eastern hemlock and Northern white-cedar are not only the preferred deer browse for northern regions of Wisconsin, but necessary components of a winter diet. To contrast, we

specifically did not include balsam fir, as this species while abundant for winter browse, will not provide a sufficient diet to solely sustain white-tailed deer during winter. Studies have shown that white-tailed deer will die when only balsam fir is available.

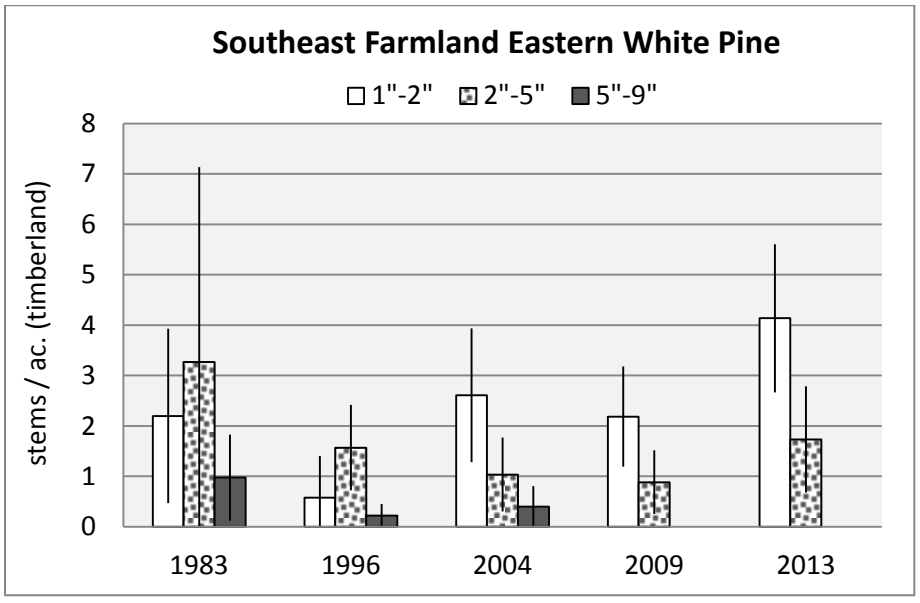
Limitations and precautions

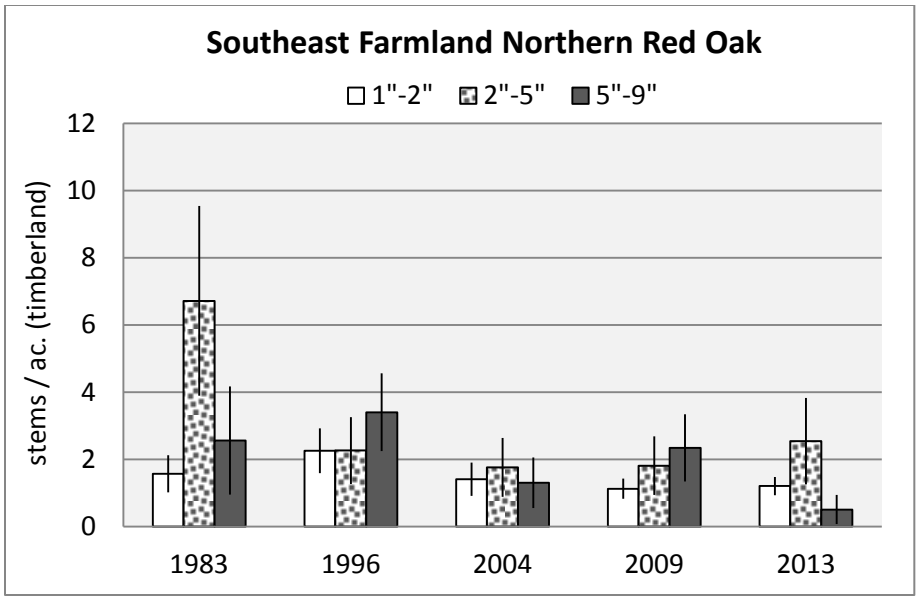
One of the limitations to all scientific data is the number of plots used to collect data. At the end of the results section, we provide the number of plots used to compile and calculate the data illustrated in the county grouping graphs. This analysis specifically did not use "browse indices" as part of our analyzed dataset. This is because there are no long-term data on deer browse, which means we would not be able to compare current day browsing rates to historical browsing rates. Secondly, the methodology of deer browse metrics is still being debated. As of today, only "current-year" deer browse is assessed, which can be challenging to measure and may often under-estimate the true amount of browsing. Finally, in some areas in which regeneration has failed, either due to over-browsing, climate or soil conditions, no stems are available to browse, thereby producing a result of "no browsing" and creating a fall sense of assurance that our forests are in a healthy state. It is our desire to further refine the deer browse metric through time to provide CDACs with a thorough set of forest metrics in the future.

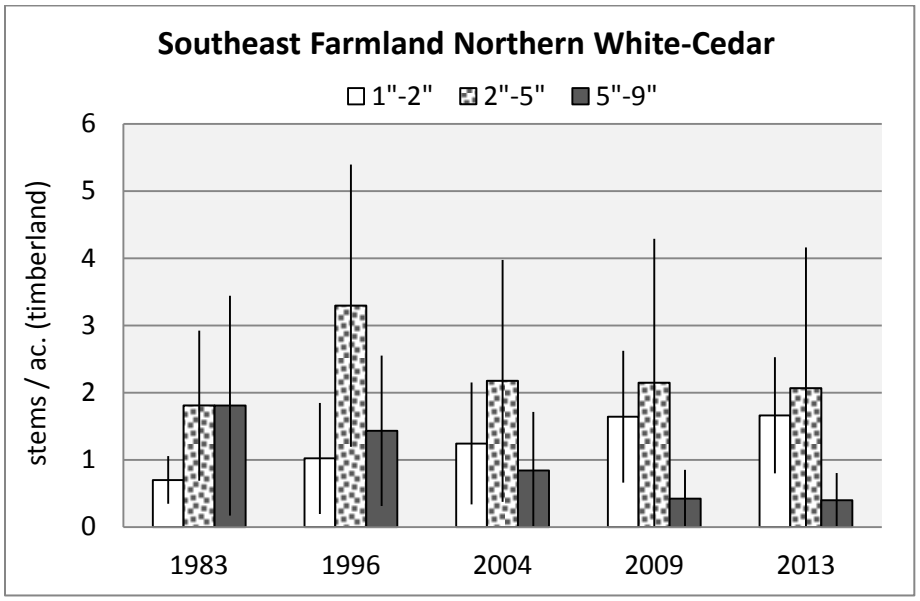
Results

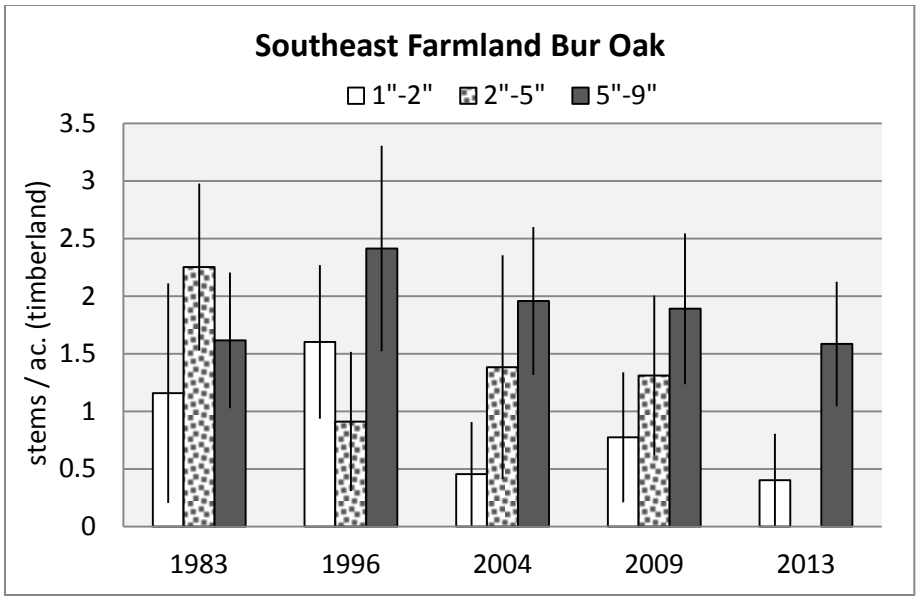
Southeast farmland county grouping

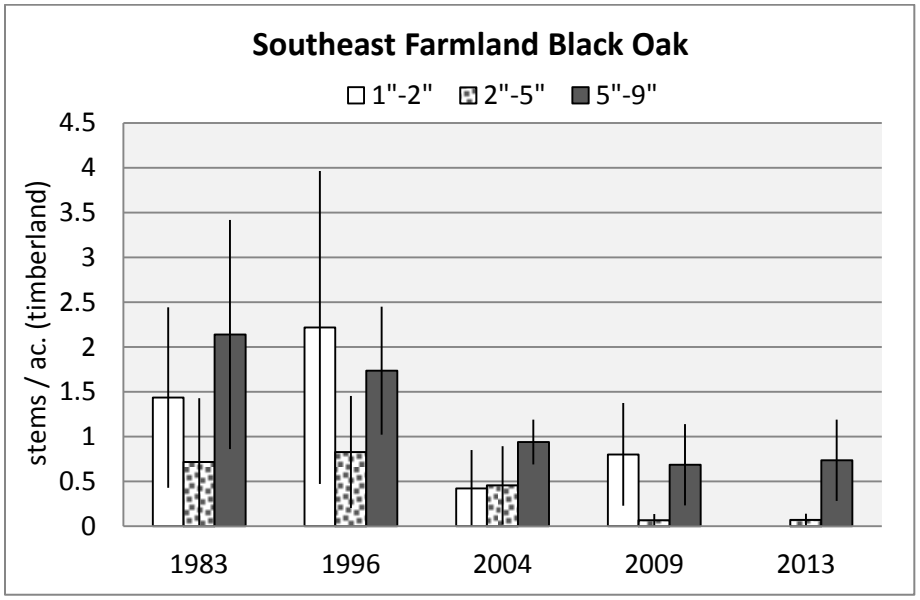
For this group we analyzed eastern white pine, northern red oak and northern white-cedar along with white oak, bur oak and black oak. Northern red oak, northern white cedar and white oak all show good regeneration. Eastern white pine has not had a measurable pole class since 2004. Bur oak had no saplings in 2013 and black oak had no seedlings in 2013.

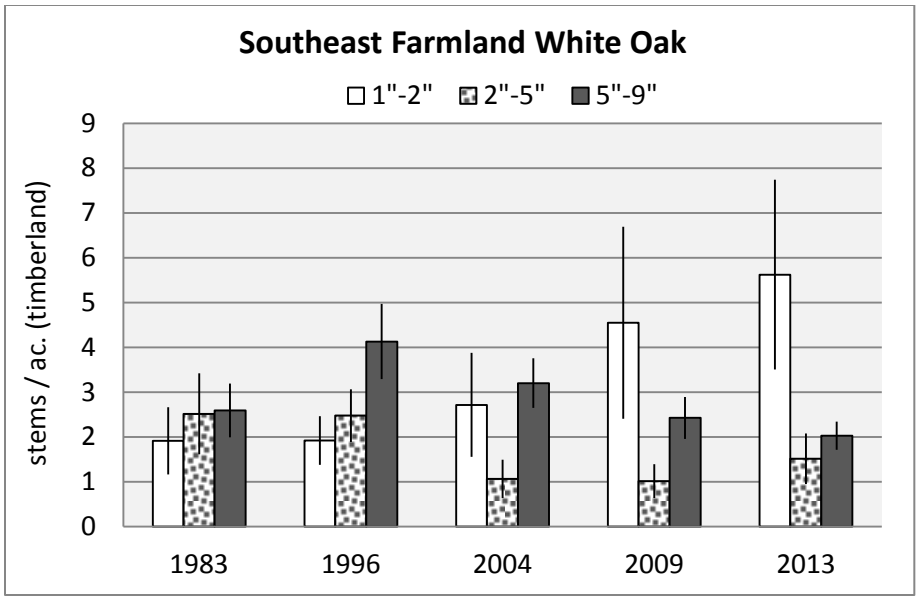



Southeast Farmland Northern Red Oak
1"-2"
2"-5"
5"-9"
stems / ac. (timberland)
12
10
8
6
4
2
0
1983
1996
2004
2009
2013


Southeast Farmland Northern White-Cedar
1"-2"
2"-5"
5"-9"
stems / ac. (timberland)
6
5
4
3
2
1
0
1983
1996
2004
2009
2013

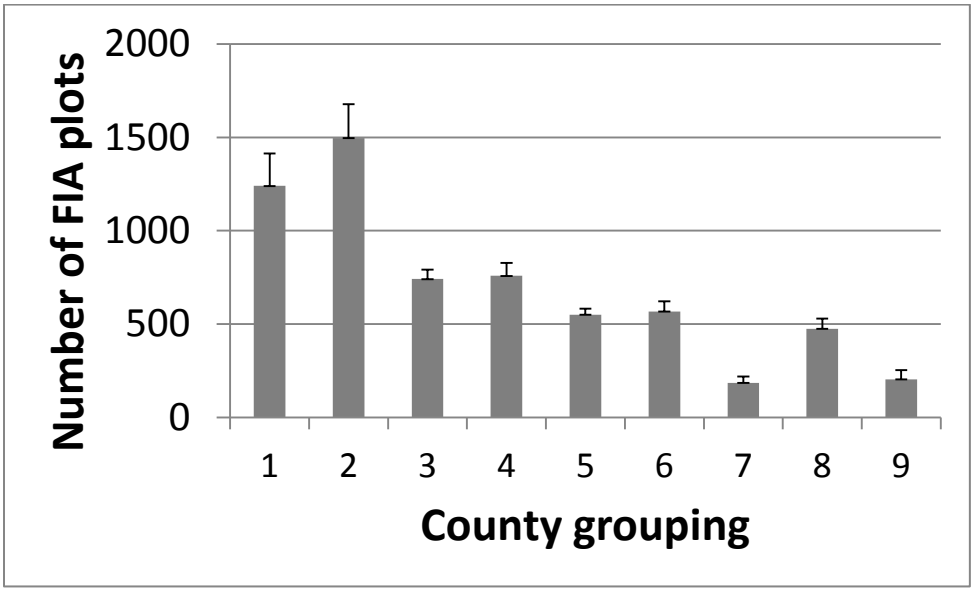

Southeast Farmland Bur Oak
1"-2"
2"-5"
5"-9"
stems / ac. (timberland)
3.5
3
2.5
2
1.5
1
0.5
0
1983
1996
2004
2009
2013


Southeast Farmland Black Oak
1"-2"
2"-5"
5"-9"
stems / ac. (timberland)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1983
1996
2004
2009
2013



Number of FIA forested plots per county group

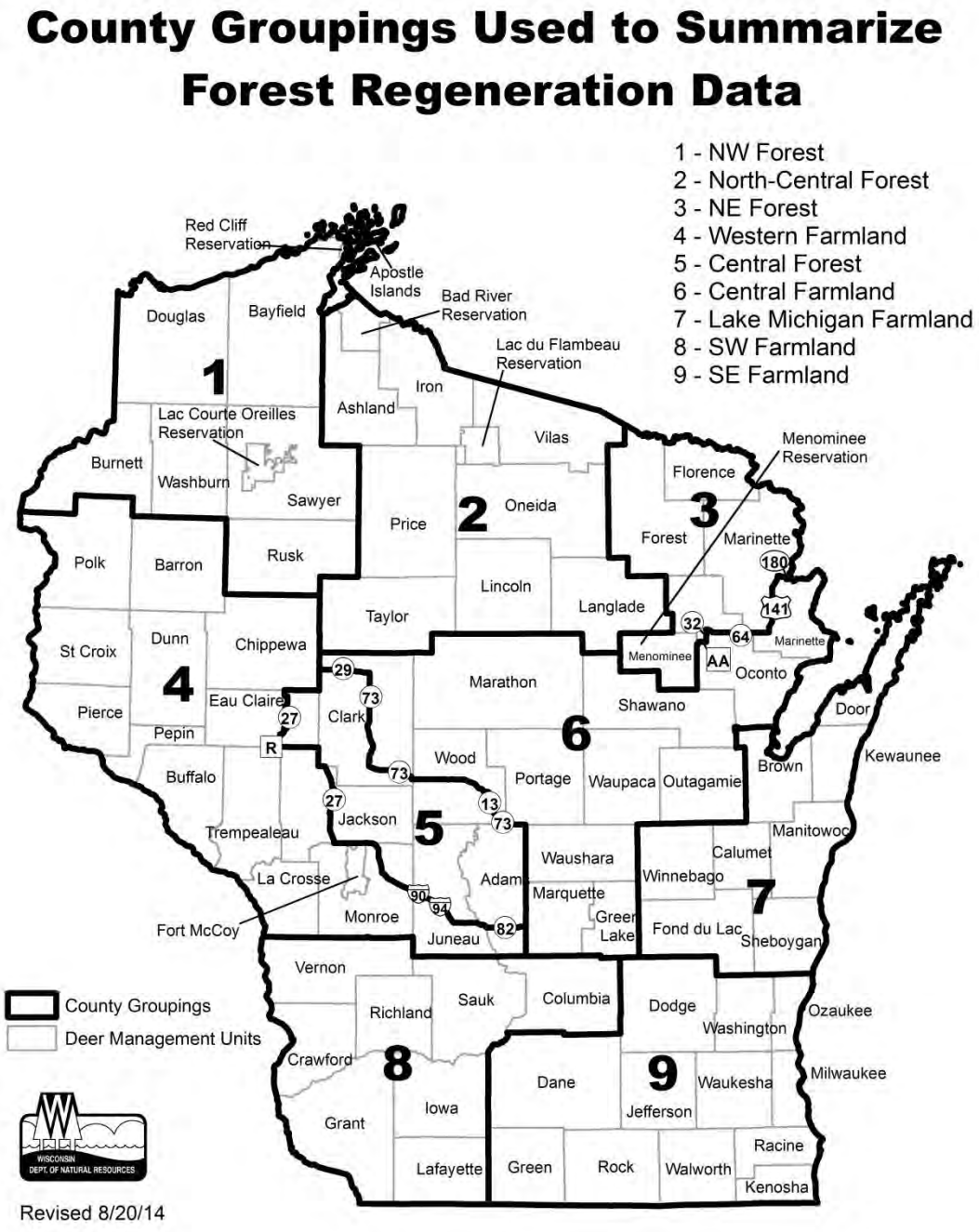
The below figure shows the average number of forested FIA plots per county grouping. The number of plots per group does change between measuring periods. The variation in the number of plots is captured by the standard deviation error bars that are provided. The figure shows that county groups with high proportions of forest have greater number of forested FIA plots than the county groups with higher proportions of agriculture and non-forested land.



Future needs

These FIA data provide a good overview of each region's tree species density. Increasing the amount of sampling plots in the future would provide a better spatial resolution, if desired. Furthermore, if enough plots were created per county, we could provide similar data on a county-level basis, verses a regional level. By partnering with county forests and industrial forests in the future, we may be able to secure these needed data and provide county-level forecasts.

While our data has the ability to show what species density was and currently is, what we don't know are the critical tipping points for needed changes in management. For example, if we don't have a sapling size class for Eastern hemlock, what are the long-term consequences? What is the number of hemlocks per acre needed to sustain a specific number of deer through a severe winter? At what density of hemlocks should we worry about long-term regeneration failure? These are the bigger questions that we need answers for. Answers to these types of questions will only be answered with further scientific research.



Human Dimensions Metrics

Metric Type: Human Dimensions Data

Background: People both influence and are influenced by the number and type of deer interactions that they experience. Deer interactions in turn can be perceived positively or negatively depending on one's identity, motivations, expectations, and prior attitudes toward deer. Like with all wildlife species, there is a social carrying capacity that may affect public preferences for having more interactions (e.g., seeing deer while hunting) and set tolerance limits for the undesirable types of interactions (e.g., vehicle crashes, damage to landscaping, etc.). What makes deer management challenging is that one person's benefit is often another person's nuisance or cost. The DNR is legally tasked with managing deer with everyone's interest in mind, while also safeguarding the long-term productivity of deer and its habitat.

Rather than guessing about what people think or want, or making assumptions, the task of trying to understand differences in preferences among different segments of the public can be approached through scientific methods. Most often, we have used surveys or questionnaires to quantify what people desire. We will provide a summary of what we have learned from some of these "human dimensions" studies. We can also include some data on spending and hunter participation from which one might a) infer the relative importance of deer hunting in the state and b) track future changes in these figures to the extent that deer populations have a direct influence on them.

Collection and analysis methods:

Human dimensions data has typically been collected more episodically than some of the biological deer metrics like harvest data that are collected on an annual basis. Human dimensions data are most often collected during the emergent or active stage of some high profile deer management issue like the emergence of CWD or declining hunter recruitment. There are some exceptions to the sporadic nature of HD survey work. For example, annually we do conduct hunter harvest surveys via the mail, and these surveys can solicit opinions about deer management and deer hunter satisfaction (see Surveys Metric).

The most reliable and representative public data come from mail surveys that are administered to a randomly selected population of interest. Although Internet or web surveys appear increasingly these days, this method is generally considered inferior to mail surveys because of lower response rates and non-random participation of intended audiences.

Using the metric:

We have highlighted some key results from relevant HD surveys done using scientific methods and which produced findings that apply most directly to the charge of the CDACs (see Table). In summary, much of this data has suggested that deer hunters in most areas of the state would likely prefer higher deer numbers than have been experienced during the past five years. The results also found that very few deer hunters seem to perceive or recognize "problems" that others might offer as rationale for reducing deer numbers. Our findings show somewhat of a disconnect in recognizing the trade-offs between high deer numbers and habitat decline over time.

Table of Recent Human Dimension Studies

Study (year)	Population of interest	Major finding/ metric(s)
2014 Analysis conducted in conjunction with Wolf Attitude study	All 2013 Resident gun deer license holders	• Deer hunting participation rates by county vary widely across the state. These rates are provided in the Appendix.
2012 Gun deer hunter retention survey	Male gun-deer hunters aged 35-55 who dropped out in 2010 and 2011	• Lack of deer and frustration with deer management were cited as first and third (land access was #2) leading reasons for declining retention among men aged 35-55 in the state.
2012 Comparison of retained hunters to drop-outs	Male gun-deer hunters aged 35-55: those who dropped out for previous 2 years versus those who had hunted last 6 seasons	Hunters who dropped out were: • less likely to have private land access; • more likely to hunt in smaller groups, • less successful harvesting deer in recent past; • more likely to hunt in a DMU where deer populations had declined by 30% or more in previous 5 years.
2011 Hunter Demographics Study by UW Applied Population Lab.	All resident male gun hunters in the state	• Predicted a 27% decline in gun deer hunting licenses sold bv 2025 based on current demographic trends.

Study	Population	Highlights
2008 DNR Credibility with Deer Hunters	All resident gun-deer hunters over 18 years old.	• 53% thought deer in their DMU were below carrying capacity; 13% said deer were above carrying capacity. • 57% supported an increase in deer numbers in their DMU (from 2007); 23% wanted them maintained; 14% supported a decrease. • Most deer hunters rejected the idea that auto collisions or deer over browsing were problems in their DMU • Hunters trusted their own observations more than agency scientists.
2008 Study of Private landowners	Statewide random survey of landowners 10+ acres	• 90% of private land has been hunted in past 5 years; 56% of landowners hunted their own land. • Three-quarters of landowners think they already have proper number of hunters for their land. • Low interest (12%) in allowing more hunter access. • Thirty-nine percent of landowners statewide thought deer numbers had decreased in previous five years; 38% said numbers were unchanged; 19% thought deer had increased. • 63% of landowners in the northern forest region thought deer numbers had decreased in past 5 years • 23% of western farmland region landowners thought deer numbers had decreased in past years; 38% said unchanged; 35% said increased. • Statewide, 47% of landowners thought number of deer on their land was “about right”; 25% said “too few”; 20% said “too many”. Four in ten landowners of northern and central forest regions said “too few”. Over half in eastern and central farmland said “ about right”.

For more information on any of these studies: Contact Robert Holsman at (608)264-8592 or robert.holsman@wisconsin.gov

Limitations and precautions: Collecting public input that is representative and unbiased is difficult and expensive. While our efforts in this endeavor were praised in the Deer Trustee Report, there are some significant shortcomings in our available data sets when it comes to the task of helping County Deer Advisory Committees in their deliberations at a county level scale. The most obvious limitation is that we have not collected opinion data in large enough sample sizes to describe counties individually (and it may be cost prohibitive to do so). Therefore most of our human dimension data can only be applied at a state or regional level. Second, in a similar fashion to habitat conditions that can change from year to year, social data can change too. Many of our statewide deer hunter surveys are now getting old, and may be of declining utility. Third and perhaps most significant, our inventory of opinion data is almost exclusively focused on deer hunters, and landowners to a lesser extent. That leaves important holes when considering

how to incorporate the perspectives of other important stakeholder groups (e.g., farmers) or the broader public.

Future needs:

Opinions about deer and how many are appropriate for each county will likely vary considerably within the state based on factors such as the number of hunters per capita in the population, differences in landscape features, amount/quality of deer habitat, and differences in distribution of public land. It will be a continuing challenge to find resources to conduct large enough statewide samples of hunter opinion that could be disaggregated to provide county specific data. Therefore, we will need to develop cost efficient ways to gather scientific opinion data from other non-hunting audiences who are also important and whose deer preferences may differ. As we define and refine many of the other the deer metric topics (e.g., ag or forest damage) for CDAC consideration, we anticipate additional HD data needs being generated.

Meanwhile, a subcommittee of personnel across agency programs and a representative from the private sector met this year and brainstormed a number of potential ways in which additional social (and biological) deer metrics might be developed and measured. Some of these ideas would involve expansion of existing citizen science efforts, and also necessitate increased cooperation with other state and local partners. These ideas are also provided in the Appendix. Besides future development by DNR, these ideas may include options that a CDAC could pursue independently

Economics of Deer in Wisconsin
Background and Current Figures

William D. Walker[1]
Draft Version 0.8 — August 15, 2014

About this Draft

The department is pursing two related projects involving deer economics: updating the 1998 Tan Book and proving supporting information to the county deer advisory committees.

This memorandum is background material for use by those project teams. I have written it without detailed knowledge of the teams' plans or needs. It makes the general points that I think are most important to understanding deer economics in Wisconsin. Corrections or suggestions are welcome.

After a brief lecture on concepts in deer economics, the memo gives current figures on hunter participation and expenditures. The last section outlines the very limited data available on deer damage.

It is worth remembering the distinction between *human dimensions* work and *economics.* The former is about hunter opinions and attitudes, including commitment to the sport; preference for hunting over substitutes; preference for deer over other types of wildlife; hunting as a social event; and intergenerational traditions. The department's social science staff have a wealth of information on those topics.

Hunter opinions or attitudes become *economic* topics when they are placed under real-world constraints on time and money. That is economic research well-beyond the scope of this memo.

Concepts in Deer Economics

Limited Data

[1] William D. Walker, J.D., Ph.D. Economist, Wisconsin Department of Natural Resources, Office of Business Support, Science and Sustainability.
william.walker@wisconsin.gov

This is a brief overview of the economics of deer in Wisconsin.

The most important point is also the most disappointing: There is not much data available on the topic. The federal government publishes estimates of statewide hunter participation and expenditures. The department has information on licensing revenues and deer damage payments. But we do not have details at the county level. Nor do we have data on how *changes* in deer management would affect economic results.

Gathering more data is prohibitively difficult. On the other hand, the available data gives a picture of the current role of deer in the state's economy. Furthermore, the economic ideas summarized below can help clarify thinking and planning around deer management.

Present Conditions vs. Possible Changes
There are two general questions to ask about deer economics:

1. What are the *present conditions*? For instance, how much do deer hunters *presently* spend in Wisconsin?
2. Given some policy proposal, how would that proposal *change conditions*? For instance, if herd size were decreased by ten percent, how much would hunter spending *change*?

Having an answer to the first question is no help with the second question. However, the second question is often the one policy-makers want answered. In the absence of costly research on impacts, the best one can hope for is a rough estimate of effects. I also think it is helpful merely to remind oneself that information about present conditions is not sufficient to choose policy.

Costs, Benefits, and Commercial Activity
Economic effects of deer come in two categories:

1. *Recreation* associated with deer, including people's enjoyment of hunting and revenues to hunting-related businesses.
2. *Damage* to property caused by deer, including crop damage and deer-vehicle collisions.

One is tempted to label those categories "benefits" and "costs", respectively but that is sloppy. One who enjoys watching deer receives a *benefit* from that activity but also incurs a *cost* by spending on travel, clothing, etc. That spending is a *benefit* to the vendors who receive it. Similarly, one whose vehicle is damaged incurs a *cost* of repair, but that cost is a *benefit* to the shop that makes the repair.

The vehicle damage example warns us about an important but overlooked point: an activity that involves a lot of spending is not necessarily beneficial to society overall.

There is data available about the spending associated with deer, including recreational spending. That information helps us assess the amount of *commercial activity* associated with deer, but it does not by itself help us assess the overall social *costs* and *benefits* of deer. Indeed, the question is not really answerable, because benefits and costs are spread unevenly among groups. One group's improved recreational opportunity is another group's increased risk of car accidents.

Hunting Figures[2]

Participation

Summary Points

Hunting (all species) is a popular activity in Wisconsin.

- In 2011, there were about 895,000 residents and nonresidents 16 years old and older who hunted in Wisconsin.
- Eighty-five percent of those hunters were Wisconsin residents, a total of about 763,000 people.
- Resident hunters are about 16 percent of Wisconsin residents over age 16.[3]

Deer hunting is by far the most popular form of hunting in Wisconsin.

- The national survey estimates that, in 2011, 88% of hunters participated in deer hunting. (See pp. 9–10 of the Wisconsin report.)
- In 2011, deer and other big game hunters spent $1.6 billion on trips and trip-related equipment. (See table 18 in the Wisconsin report.)

Hunter Participation (All Hunting)

The next two tables are reproduced from pp. 9–10 in the Wisconsin report:

Hunters in Wisconsin
(State residents and nonresidents 16 years old and older)

	Hunters	*Days of Hunting*
Residents	763,000	10,100,000
Nonresidents	131,000	2,100,000
	895,000	**12,200,000**

[2] Except where noted, figures come from the Wisconsin report from the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, conducted by the U.S. Census Bureau for the U.S. Fish and Wildlife Service ("national survey" and "Wisconsin report"). http://www.census.gov/prod/2013pubs/fhw11-wi.pdf.

To my knowledge, there is no more thorough, accurate, and regularly updated source of hunting expenditure information. (Third-party studies usually rely on national survey data and add interpretation or secondary analysis.)

The department's internal estimates are more accurate (and lower) than those estimated by the national survey, because the national survey uses self-reporting instead of license sales. However, national survey estimates are widely used by other organizations and media outlets. We feel that the value of sharing comparable figures outweighs the risk of mis-estimation.

[3] State population estimates are from the U.S. Census Bureau. See first the Wisconsin QuickFacts page. http://quickfacts.census.gov/qfd/states/55000lk.html.

Hunting Expenditures in Wisconsin
(State residents and nonresidents 16 years old and older)

	Expenditures
Trip-related	$358,000,000
Hunting Equipment	137,000,000
Auxiliary and Special Equipment	1,300,000,000
equipment subtotal	*1,500,000,000*
Other	722,000,000
	$2,500,000,000

Hunting by Type of Game

The following table is extracted from table 13 in the Wisconsin report:

Hunters in Wisconsin by Type of Game: 2011
(Population 16 years old and older)

Type of Game	*Number of Hunters*	*Percent of Hunters*
Deer	785,000	88%
Wild turkey	230,000	26%
Small game (all)	219,000	24%
Migratory birds (all)	105,000	12%
All Game	**895,000**	

Notes:

- Hunter counts and percentages do not sum to 100% because multiple responses were allowed per type of game.
- The original table includes more categories of game than given here. However, response rates for those categories were too small to yield valid hunter number estimates and the original table reports no figures for those categories.

Rank Among States

Wisconsin is ranked second among all states in the number of resident hunters and non-resident hunters.

The following two tables are reproduced from a document from the Association of Fish and Wildlife Agencies, which reports data from the national survey.[4]

[4] Page 9, *Hunting In America: an Economic Force For Conservation*, January 2013. A report funded by the National Shooting Sports Foundation, produced in partnership with the Association of Fish and Wildlife Agencies. Available at this URL: http://www.nssf.org/PDF/research/HuntingInAmerica_EconomicForceForConservation.pdf.

Top 10 States Ranked by Non-Resident Hunters

Rank	*State*	*Number of Hunters*	*2011 Retail Sales*
1	South Dakota	143,531	$405,440,166
2	**Wisconsin**	**131,137**	**313,886,596**
3	Colorado	115,491	195,925,340
4	Kansas	112,408	116,442,906
5	Virginia	106,010	135,714,544
6	Missouri	99,646	140,567,785
7	Georgia	98,169	174,006,756
8	Idaho	84,613	301,249,528
9	New York	84,151	114,921,425
10	North Carolina	76,383	$47,735,700

Top 10 States Ranked by Resident Hunters[5]

Rank	*State*	*Number of Resident Hunters*	*2011 Retail Sales By Resident*
1	Texas	1,079,869	$ 1,946,850,446
2	**Wisconsin**	**763,384**	**2,251,833,862**
3	New York	739,260	2,137,567,880
4	Pennsylvania	698,988	881,787,890
5	Ohio	515,723	793,798,774
6	Michigan	501,421	2,303,119,552
7	Alabama	491,593	1,114,811,944
8	Missouri	476,833	844,434,657
9	Illinois	458,984	1,254,796,442
10	Minnesota	456,695	$ 670,323,496

Expenditures

All hunting-related expenditures in Wisconsin totaled $2.5 billion in 2011.

- Trip-related expenses, such as food and lodging, transportation, and other trip expenses, totaled $358 million — 14 percent of total expenditures.
- Hunters spent $1.5 billion on equipment — 58 percent of all hunting expenditures.
- For all types of hunting in 2011, the average expenditure per hunter was $2,833. (See table 20 in the Wisconsin report.)
- Considering only trip-related expenditures, for all types of hunting in 2011, the average trip-related expenditure per hunter was $400. (See table 20 in the Wisconsin report.)

[5] Expenditures reported are retail sales, a subset of the total expenditures reported elsewhere in this document.

Although a relatively high percentage of state residents (16%) participate in hunting, hunter spending accounts for a smaller share of state economic activity than participation would suggest.

- Total Wisconsin Gross Domestic Product was $263.1 billion in 2011.[6]
- Total hunter spending ($2.5 billion) is equivalent to slightly less than one percent of 2011 Wisconsin GDP.[7]
- For comparison, categories that account for the largest share of 2011 state GDP include real estate ($31.3 billion), insurance ($11.5 billion), and ambulatory health care ($10.7 billion).

Deer Damage

Deer damage is typically discussed in three general categories, vehicles, agriculture, and forestry:[8]

- Deer-vehicle collisions
- Crop damage
    - High-valued agriculture
    - Grains
    - Nursery stock
    - Residential & commercial landscape
- Forestry damage

Surprisingly, I am unable to find ongoing, standardized estimates of deer damage. There are several point-in-time studies, including a 2002 estimate of total U.S. crop damage from wildlife.[9] The USDA Animal and Plant Health Inspection Service runs a wildlife damage program, but its data reports lack state-level detail.[10] The Wisconsin Agricultural Statistics Service reports data on freeze and wind damage, but I am unable to find any on wildlife damage.[11] The state's wildlife damage program may be the most consistent source of information on damage, but of course it assesses payments only, not total damage.

A 2005 study estimated the cost impact of various types of deer damage for 13 northeastern U.S. states. Deer-vehicle collisions were the largest impact, at 61% of total. Of course, the setting in the north east is

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[6] State Gross Domestic Product data are from the U.S. Bureau of Economic Analysis, regional economic accounts. http://www.bea.gov/regional/index.htm.

[7] The comparison of hunter expenditures and total state GDP is provided to illustrate relative size. The expenditure and GDP figures are estimated using different methods making detailed comparison impossible.

[8] See, e.g., Drake, Paulin, et al., 2005. Assessment of Negative Economic Impacts from Deer in the Northeastern United States, *Journal of Extension*, 43(1). http://www.joe.org/joe/2005february/rb5.php.

[9] USDA National Agricultural Statistics Service, 2002. "U.S. Wildlife Damage", press release.

[10] http://usda01.library.cornell.edu/usda/current/uswd/uswd-05-03-2002.pdf

[11] http://www.nass.usda.gov/Statistics_by_State/Wisconsin/index.asp

very different from Wisconsin and it should not be assumed that these proportions or totals are representative of Wisconsin.

Type of Impact	*Economic Impact*	*Percentage*
Deer-vehicle Collisions	$390,520,000	61%
High-value Agricultural Depredation	94,347,840	15%
Grain Crop Depredation	77,213,417	12%
Nursery Stock Depredation	27,878,180	4%
Residential/Commercial Landscape Depredation	49,000,000	8%
	$638,959,437	100%

Table 1. Annual Estimated Economic Impact from Deer-Vehicle Collisions and Deer Damage to Select Agricultural Crops, Nursery Stock, and Commercial and Residential Landscaping for 13 Northeastern United States. Reproduced from Table 5 in Drake, Paulin et al.[12]

The reference list for the study illustrates the data problem. To arrive at their estimates, Drake, Paulin, et al. pieced together occasional state crop reports and point-in-time studies from the wildlife management literature.

A more precise and detailed estimate of crop damages in Wisconsin would require a more thorough review of the literature and likely additional research.

[12] Supra, note 8.

Deer-Vehicle Collision Metrics

Metric Type: Deer Vehicle Collision Data

Background: Deer-vehicle collisions (DVCs) are one of the most visible negative impacts that deer populations have on society. As managing deer involves balancing the positive benefits of deer with their negative impacts, it makes sense to consider DVCs when making deer management decisions. Also, it seems like common sense that changes in numbers of DVCs would be strongly related to changes in deer numbers. If this is true, then looking at DVC numbers over time would help us know how deer numbers are changing. So we have 2 good reasons to want data on DVC numbers: 1) to document impacts of deer on society, 2) as an additional tool to monitor deer populations.

Collection and analysis methods:
In WI, there are several datasets related to deer-vehicle collisions. They are: 1) reported vehicle crashes with deer, 2) human injuries resulting from deer-crashes, 3) deer carcasses removed from WI roadways, 4) salvage permits issued to citizens wishing to take car-killed deer, 5) insurance claims for deer-vehicle accidents. In all cases, data is available on an annual basis.

1. The Wisconsin Department of Transportation (DOT) has kept track of reported DVCs on a statewide basis since 1979, but only on a county basis since 1987. The DOT publishes an annual summary of DVC data (see Appendix 1). Accidents must be reported to DOT if the reporting threshold ($1000+ property damage, and/or injury, and/or $200 damage to public property) is met. In 1996, the monetary threshold for property damage changed from $500 to $1000. Reports can either be written by law enforcement or citizens involved in the accident, however, only law enforcement reports are included in annual DVC counts.
2. Reported injuries resulting from vehicle-deer crashes are a subset of the reported DVCs that are recorded by the DOT, and have been recorded on a county basis since 1994.
3. The WIDNR has kept track of the number of deer carcasses removed from roadsides since 1951. Initially, DNR personnel removed and disposed of carcasses. Eventually, the DNR contracted with private citizens and county highway departments to remove carcasses; contractors were required to report the number of carcasses they removed. These data were combined with car-killed deer salvage permits (#4) until 1998. Data are available on a county basis.
4. The DNR issues salvage permits to people who wish to take a deer carcass from the road (fresh carcasses that they intend to butcher). Initially, DNR game wardens were the ones who issued permits. At some point, other law enforement agencies were allowed to issue permits and businesses which served as check stations during the hunting season were also given permits to issue. This data was included with carcass removals (#3) until 1998. Data are available on a county basis.
5. State Farm Insurance publishes estimates of DVCs, based on insurance claims; however, this is only done at the state level, so would not be useful for county-level management decisions.

Rather than report simple DVC numbers, it is standard practice to express the data as a rate (e.g. reported DVCs per million miles of traffic driven). This makes the comparison over time more 'fair', because DVCs will obviously depend on how many cars are driving the roads, and this has changed substantially over time.

For this fall, we've provided 2 datasets for each county; reported DVCs per million miles of traffic driven, and the number of car-killed deer carcasses removed from roadways by private contractors. These are the datasets that are readily available and have been published previously at the statewide level.

Using the metric:
Principally, DVC data would be used to track changes in time of DVCs, which would indicate how this impact of deer on society is changing. This data could also provide an additional source of information

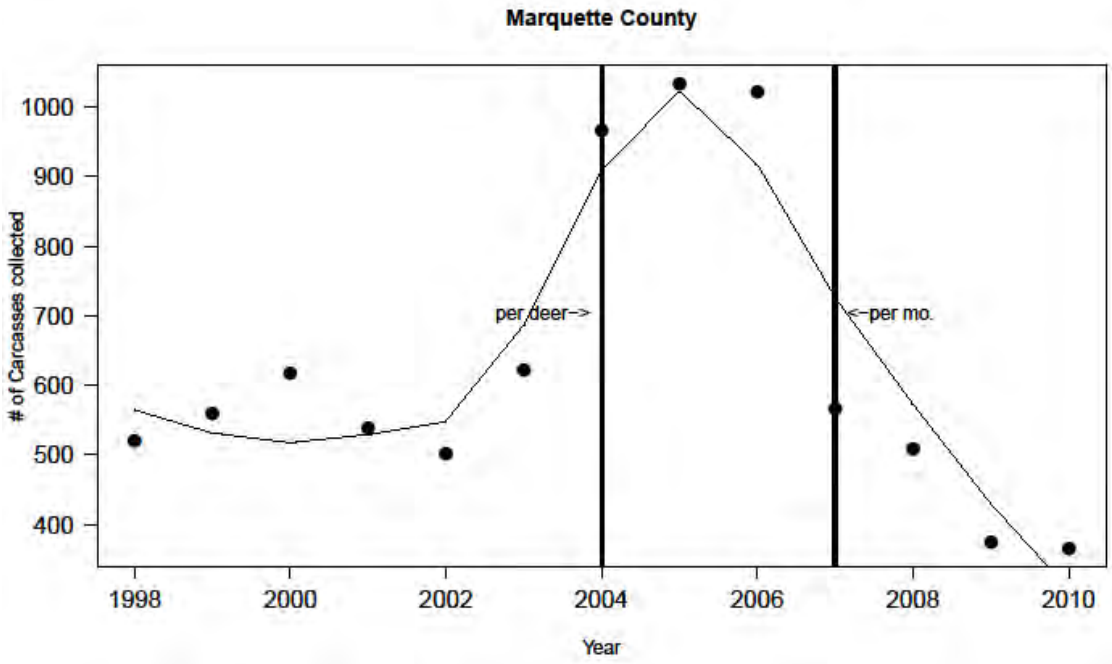
on deer population trends. CDACs would have to decide whether observed DVC levels were acceptable, and whether population objectives and antlerless quotas should be altered for the purpose of reducing DVCs. This assumes that DVC data is sound and is providing useful information.

Limitations and precautions:
It's important to realize that we never know exactly how many deer-vehicle collisions occur each year. DVC data is imperfect, so the number of DVCs in a report is not the true number of DVCs that actually occurred. However, imperfect data doesn't necessarily mean bad or useless data. What it means is that we have to understand it and take care in interpreting what the data is telling us.

Perhaps the most important thing we can do to ensure that data is useful is to collect it the same way every year and every place. If data collection is not consistent, then we cannot be sure if changes in the numbers of DVCs are real or caused by changes in data collection procedures. When wildlife biologists set up wildlife surveys, they place a lot of emphasis on collecting data in a consistent manner. DVC data is different from most data in that it hasn't been collected for the purpose of monitoring deer populations and we have little to no control over how the data is collected. The bottom line: ***consistency in data collection is critical!***

We've done some research to examine the usefulness of DVC data in Wisconsin. This involved interviewing about 35 sheriff departments in Wisconsin to determine their reporting procedures. The DVC data collected by the DOT comes strictly from law enforcement reports, so law enforcement policies and procedures have a big impact on reported DVC numbers. We found that sheriff's departments varied substantially in their policies of responding to (and reporting) DVCs; from some departments always responding, to others only responding if the vehicle was disabled in the crash or someone was injured, and everything in between. Additionally, policies for responding to DVCs have changed over time as budgets and priorities change; e.g. some counties that used to respond regularly to DVCs no longer do. This variation in procedure makes comparison between counties or across years very difficult: are changes in DVC data due to changes in the true number of DVCs, or changes in reporting?

In our investigation of carcass removal data, we also found that data collection procedures were very inconsistent. The contractors that pick up car-killed deer are currently all paid a flat, monthly fee. In the past, contractors were sometimes paid per deer. Whether a contractor is paid a flat rate or per deer makes a substantial difference in the chance a deer carcass gets picked up (and enters our data set). Large increases and decreases in the number of carcasses picked up by contractors coincided with changes in how contractors were paid (Figure 1). If a contractor is paid a flat fee, then picking up carcasses actually cuts into their profit (time and fuel expenses). The bottom line for us is that the data we receive has a lot to do with the contractor performance, so we don't believe that this data reflects the true changes in DVCs.



The bottom line: *be very skeptical of sudden, large changes in the data! These are likely due to changes in data collection, not the actual number of DVCs.*

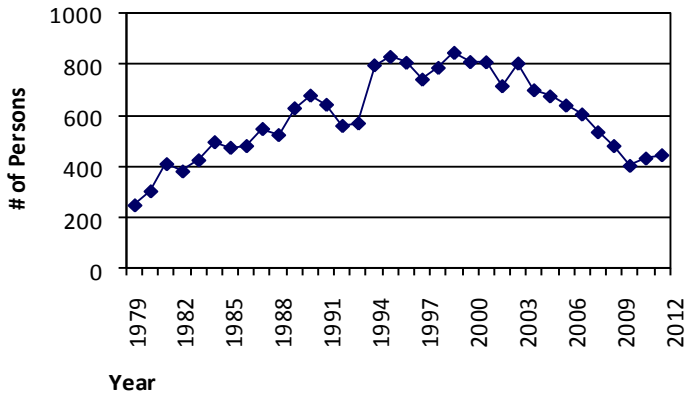
We assume that human injuries from DVCs should not have the reporting problems that the other data has. From the standpoint of providing an accurate picture of DVCs, this is could be our best bet going forward. However, human injuries from DVCs occur infrequently, so the data is probably too sparse to be useful on a county level. Additionally, it's important to know that there has been a general decline in *ALL* vehicle accidents and *ALL* vehicle injuries over time. This could be for a whole host of reasons; safer cars, better roads, more law enforcement, etc… The bottom line is that these factors could also influence changes in DVCs in a way that has nothing to do with deer numbers.

Future needs:
A DNR team has been formed which is tasked with examining the DVC data in detail. This team will identify, which, if any of the current data sources could serve as a useful DVC metric going forward. The team may recommend reforming some of the current data collection procedures, to ensure greater consistency. Additionally, we will explore the possibility of expressing our data as the % of vehicle accidents that are DVCs or the % of vehicle crash injuries that result from DVCs. The hope is that this would allow us to look at the DVC data in a way that would provide a clearer look at how deer numbers play into DVC numbers. Additionally, we may explore the option of simply asking people, as part of a survey, about their involvement in DVC.

MOTOR VEHICLE-DEER CRASHES IN 2012

Motor vehicle-deer crashes continue to be cause for concern in highway safety. Deer are the third most commonly struck object in Wisconsin (behind striking another vehicle and striking a fixed object). In 2012, 14 people died in 14 fatal motor vehicle-deer crashes. In addition, 81 people suffered incapacitating injuries; less serious injuries totaled 210; and 140 people were possibly injured.[1] A recent study by the Wisconsin Department of Transportation made the following discoveries:

Figure 1:
Motor Vehicle-Deer Crashes:
Persons Injured or Killed (1979-2012)



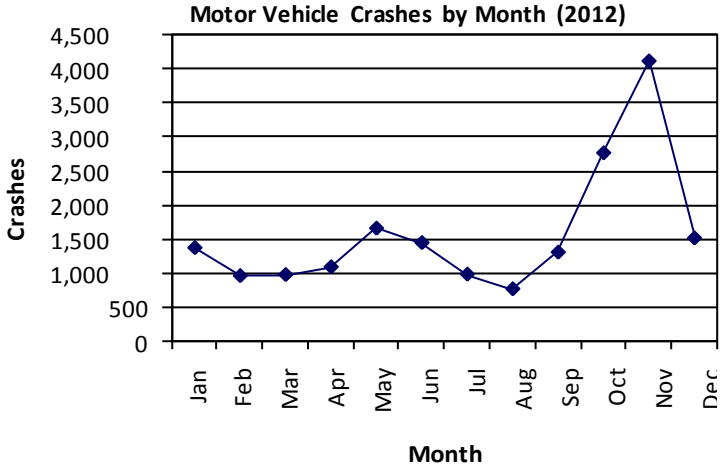
- **The number of persons injured or killed in deer crashes has increased since the late 1970s**. Since 1979, there has been a general increase in the number of persons injured or killed in motor vehicle crashes with deer. However, we are seeing a slight uptick from the previous decline. The 445 people injured or killed in 2012 is the 8th lowest annual total in 34 years of record keeping. 1999 was the highest with 847 (Figure 1).

- **Deer crashes peak in October-November with a secondary peak in May-June**. In 2012, investigating officers reported 18,895 motor vehicle-deer crashes.[2] Of those, 6,904 (36.5%) occurred in October and November. The secondary peak time of May-June included 3,094 crashes (16.4%) (Figure 2).

- **While October and November are the peak months, June often accounts for a surprising number of injuries.** In 10 of the last 17 years, June ranked as the worst or second worst month for injuries. In 2012, injuries were the worst in June with 75 injuries, 58 in July and 53 in October.

- The main peak in October-November occurs when the deer enter the mating season, also known as "The Rut" and are very active in their movements. The secondary peak in May-June is the result of inexperienced young deer that have been pushed out onto their own by mother and are less careful when wandering around

Figure 2:
Motor Vehicle Crashes by Month (2012)

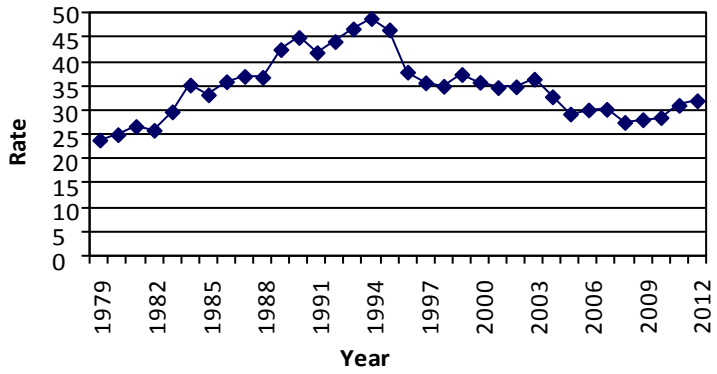


1 "Possible injury" is defined as any injury that is not evident at the scene but that is claimed by the individual or suspected by the law enforcement officer. 2 Effective January 1, 1996, "property damage only" crashes with less than $1,000 damage need not be reported. Previously, the threshold was $500. Hence, reported property damage only crashes sustained a substantial drop overall during the past five years.

- **In three Wisconsin counties, motor vehicle-deer crashes outnumbered non-deer crashes**. In Green Lake, Shawano, and Taylor Counties, more than half of all police-reported crashes involved deer in 2012.

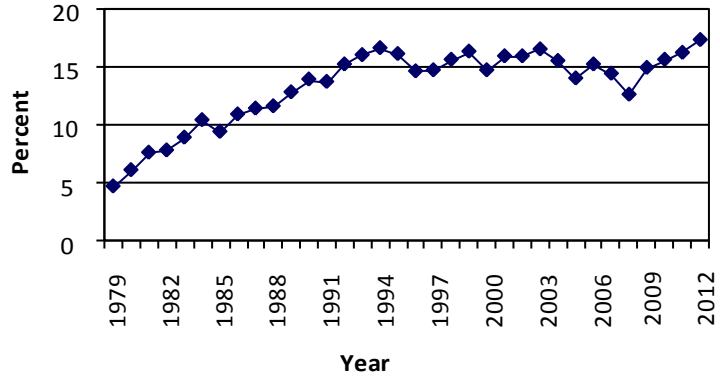
- **Dane, Shawano, and Waukesha counties had the highest number of reported deer crashes**. Dane County had the most motor vehicle-deer crashes reported in 2012 with 851. Shawano followed with 800 and Waukesha had 710.

Figure 3:
Motor Vehicle Crashes per 100 Million VMT (1979-2012)



- **The number of reported deer crashes per 100 million vehicle miles traveled peaked in 1994.** In 1996, the rate declined sharply, tapering off through 2003, with a further decline to an average of 28 crashes per 100 million vehicle miles traveled in 2008 thru 2010. There is a noticeable increase in 2011 (Figure 3).

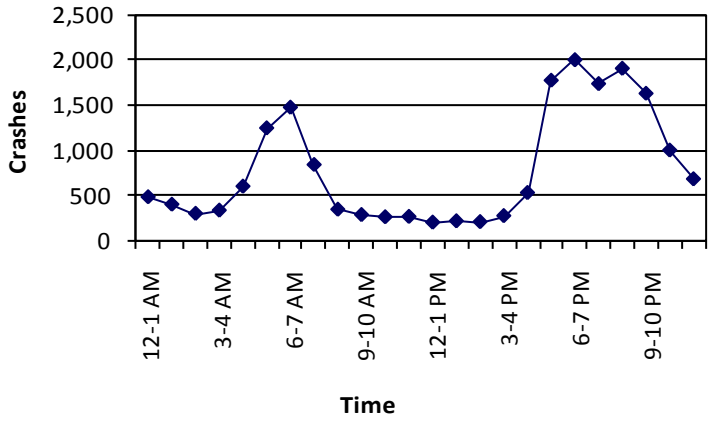
Figure 4:
Deer Crashes as a Percentage of All Motor Vehicle Crashes (1979-2012)



- **Deer crashes account for a growing percentage of all reported crashes**. In 1978 and 1979, deer crashes accounted for only 5.1% and 4.7% of all crashes, respectively. From 1996 to 2012, the number of deer crashes as a percentage of all yearly crashes averaged 15.3% (Figure 4).

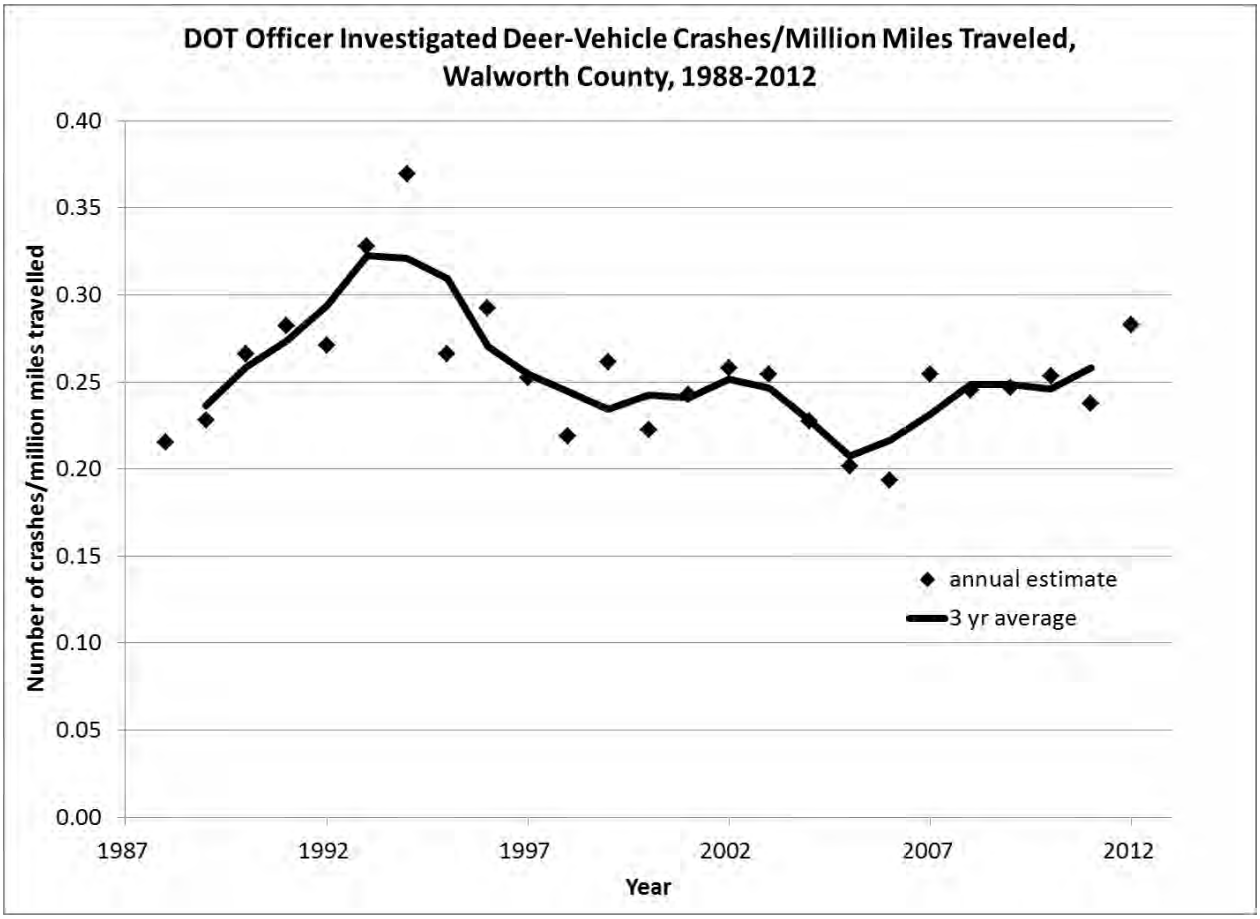
- **Deer crashes typically occur in rural settings**. In 2012, 17,064 of the 18,895 (90.3%) deer crashes occurred on rural roads.

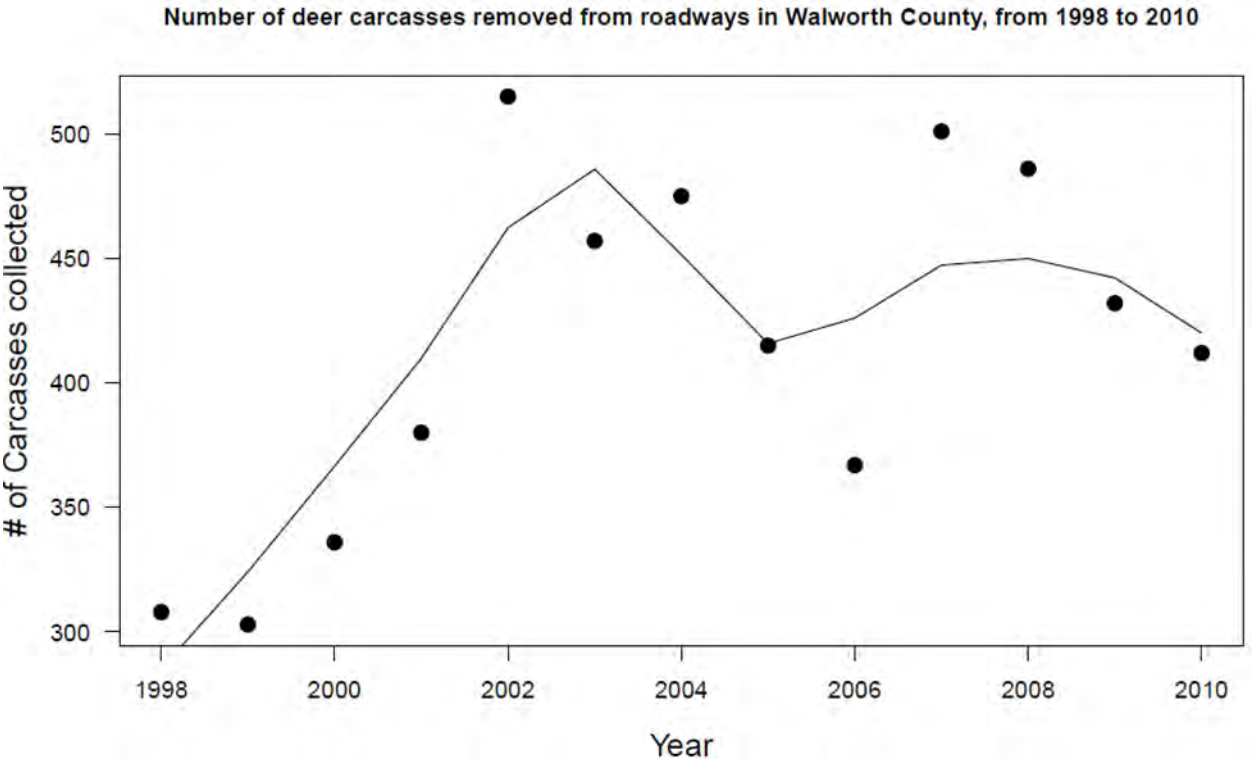
Figure 5:
Motor Vehicle-Deer Crashes by Time of Day (2012)



- **Motorcyclists need to be particularly alert to deer.** In 2012, while only 12.9% of passenger cars and 7.4% of utility trucks involved in deer crashes resulted in a fatality or injury to an occupant, 69.9% of motorcycle-deer crashes resulted in a fatality or injury to a motorcyclist. Thirteen of the 14 motor vehicle/deer crash fatalities in 2012 were motorcyclists.

- **Deer crashes follow time of day patterns.** In 2012, deer crashes occurred between 5 a.m. to 8 a.m. in the morning and 5 p.m. 11 p.m. in the evening. This corresponds to both the feeding habits of deer as well as the morning and evening times of people commuting to and from work (Figure 5).


DOT Officer Investigated Deer-Vehicle Crashes/Million Miles Traveled,
Walworth County, 1988-2012
Number of crashes/million miles travelled
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1987
1992
1997
2002
2007
2012
Year
annual estimate
3 yr average


Number of deer carcasses removed from roadways in Walworth County, from 1998 to 2010
# of Carcasses collected
500
450
400
350
300
1998
2000
2002
2004
2006
2008
2010
Year